kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 21 May 2021. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Differentiate between "correlation analysis" and "regression analysis". (2 marks)

(b) Compu World Limited assembles and sells computers. The company estimates that if it optimally assembles computers, it could sell between 1,100 and 2,000 computers per month and the monthly revenue (in thousands of shillings) over this range of sales could be represented by the function $R = 1{,}000x - 200x^2$.

Where: R is the monthly revenue.

x is the number of computers sold per month (in thousands).

The company estimates that its marginal cost (in thousands of shillings) could be represented by the following function:

$MC = 200x^2 - 200x + 400$

Where: MC is the marginal cost

x is the number of computers assembled.

The fixed cost of the company amounts to Sh.100,000 per month. If is assumed that all the computers assembled in a given month are sold within the same month.

Required:

(i) The total cost function. (2 marks)

(ii) The profit function. (2 marks)

(iii) The optimal monthly output. (3 marks)

(iv) The maximum profit of the company. (2 marks)

(c) The Registrar of Highfliers University has observed that the grade point aggregate of the University's students is normally distributed with a mean of 2.75 and a standard deviation of 0.40.

Required:

(i) The probability that a randomly selected student from the university has a grade point aggregate of between 2.00 and 3.00. (3 marks)

(ii) The lowest grade point aggregate that should be obtained by a student for him/her to be among the top ten per cent of the students. (3 marks)

(iii) Assuming that the university has a total of 10,000 students, determine the number of students having a grade point aggregate of 3.70 or higher. (3 marks)

(Total: 20 marks)

QUESTION TWO

(a) Highlight two properties of each of the following probability distributions:

(i) Binomial distribution. (2 marks)

(ii) Poisson distribution. (2 marks)

(b) Enumerate two advantages and two disadvantages of the ordinary least squares method of forecasting. (4 marks)

(c) An investor intends to purchase shares in one of three companies, A, B and C. The three companies have varying degrees of sensitivity to the state of the economy. There are three states of the economy classified as weak, moderate or strong. The investor has constructed the following pay off table for the profits under the three states of the economy, in millions of shillings.

	State of the economy		
Company	**Weak**	**Moderate**	**Strong**
A	-4.0	3.5	6.0
B	-2.0	2.5	4.5
C	-2.4	2.8	3.5

The probabilities for the three states of the economy are 0.2, 0.4 and 0.4 for weak, moderate and strong respectively.

Required:
Advise the investor on the best course of action based on the:

(i) Maxmin criterion. (2 marks)

(ii) Maxmax criterion. (2 marks)

(iii) Minimax regret criterion. (3 marks)

(iv) Expected value of perfect information. (5 marks)

(Total: 20 marks)

QUESTION THREE

(a) A baker makes and sells cakes to students through their cafeteria system. The distribution of cakes produced and cakes sold for the last 250 weeks is as follows:

	Number of weeks			
Number of cakes	**Cakes Produced**		**Cakes Sold**	
150	20	0-20	35	0-35
250	50	21-70	50	36-85
350	80	71-150	80	86-165
450	80	151-230	65	166-230
500	20	231-250	20	231-250

Each cake costs Sh.80 to make and is sold for Sh.120 if sold during the week of production, otherwise it is sold during the second week at Sh.60. If not sold during the second week, the cake's value drops to zero and the baker suffers the total loss of production. Weekly demand is satisfied from the week's production and any demand remaining unsatisfied is satisfied from the stock of the previous week. A stock out costs the baker Sh.20 per cake.

The following random numbers are applicable:

Cakes produced	33,	86,	50,	41,	31,	78,	30,	22,	26,	88
Cakes sold	79,	03,	40,	13,	58,	61,	72,	49,	82,	86

Required:
Simulate the baker's average weekly profit over an 8-week period. (10 marks)

(b) Kazi na Bidii Ltd. sells four types of products. The resources needed to produce one unit of each product and the sales prices are given as follows:

Cost and resources requirements for Kazi na Bidii Ltd.

Resource	Product 1	Product 2	Product 3	Product 4
Raw materials (units)	2	3	4	7
Labour hours	3	4	5	6
Sales price (Sh.)	4	6	7	8

Additional information:

1. Currently, 4,600 units of raw materials and 5,000 labour hours are available.
2. To meet customers' demand, exactly 950 total units must be produced and at least 400 units of Product 4 must be produced.
3. A computer output of the above linear programming model has been given as follows:

MAX $4x_1 + 6.5x_2 + 7x_3 + 8x_4$

SUBJECT TO:

2) $x_1 + x_2 + x_3 + x_4 = 950$
3) $x_4 >= 400$
4) $2x_1 + 3x_2 + 4x_3 + 7x_4 <= 4600$
5) $3x_1 + 4x_2 + 5x_3 + 6x_4 <= 5000$

END

LP OPTIMUM FOUND AT STEP 4

OBJECTIVE FUNCTION VALUE

1) 6650.0000

VARIABLE	VALUE	REDUCED COST
X_1	.000000	1.000000
X_2	400.000000	.000000
X_3	150.000000	.000000
X_4	400.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	3.000000
3)	0.000000	-2.000000
4)	0.000000	1.000000
5)	250.000000	.000000

NO. ITERATIONS 4

RANGES IN WHICH BASIS IS UNCHANGED

		OBJECTIVE COEFFICIENT RANGES	
VARIABLE	CURRENT COEFF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
X_1	4.000000	1.000000	Infinity
X_2	6.000000	0.66667	.500000
X_3	7.000000	1.000000	.500000
X_4	8.000000	2.000000	Infinity

RIGHT-HAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2)	950.000000	50.000000	100.000000
3)	400.000000	37.000000	125.000000
4)	4600.000000	250.000000	150.000000
5)	5000.000000	Infinity	250.000000

Required:

(i) The optimal solution to the problem. (2 marks)

(ii) The optimal solution if the company raises the price of product 2 by Sh.0.50 per unit. (2 marks)

(iii) The optimal Z-value if a total of 980 units must be produced. (3 marks)

(iv) The optimal Z-values where 4,500 units and 4,400 units of raw materials are available. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Enumerate eight applications of quantitative analysis in business. (8 marks)

(b) The following is a pay-off matrix of a zero sum two person game:

		Player B strategy				
		I	II	III	IV	V
	I	−2	0	0	5	3
Player A strategy	II	4	2	1	3	2
	III	−4	−3	0	−2	6
	IV	5	3	−4	2	−6

Required:

The optimal plan for both players. (5 marks)

(c) A beauty therapist has observed that the mean arrival rate in her beauty parlour is 6 customers per hour and the mean service rate is 8 customers per hour. The beauty parlour operates a 12 hour day.

A more efficient machine for use by the therapist is available for purchase. If the machine is purchased by the therapist, it would increase the average service rate at the parlour to 12 customers per hour. The cost of each hour lost due to a customer waiting for service is Sh.875.

Required:

(i) The average waiting cost per day. (3 marks)

(ii) Evaluate the effect of purchasing the more efficient machine on the average daily waiting cost. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Citing an example in each case, explain the difference between a continuous function and a discrete function. (4 marks)

(b) X Ltd. is considering undertaking a project which requires the following resources:

Activity	**Preceding activity**	**Duration in days**		**Total cost normal Sh.**	**Number of persons per day**
		Normal	**Crash time**		
A	-	7	5	7,500	5
B	-	6	3	6,000	4
C	-	2	2	2,500	6
D	A	5	4	6,000	5
E	B	5	4	7,000	5
F	E	6	2	8,000	6
G	E	7	6	6,000	4
H	C	6	5	7,200	6
I	H	8	5	9,800	9
J	D	4	4	3,500	3
K	J	6	5	3,600	2
L	F	3	2	7,000	12
M	G, I	8	4	9,200	6
N	K, L, M	4	2	7,700	15

The cost of crashing an activity per day is Sh.1,000.

Required:
Using network analysis, determine:

(i) The project's normal duration, normal cost and critical path. (8 marks)

(ii) The minimum time in which the project could be completed and the cost of the project. (8 marks)

(Total: 20 marks)

.....

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

MONDAY: 30 November 2020. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) A potential investor in the production of a new type of organic fertilizer estimated the demand function of the product to be AR = 150 – Q.

Where:

AR is the average revenue in thousands of shillings.
Q is the output in tonnes.

The investor estimated the variable cost (VC) per unit tonne associated with the production to be:

VC/tonne = Q – 285 in thousands of shillings.

The firm's cost when not producing any output is estimated at Sh.8,750,000.

Required:

(i) The profit function. (2 marks)

(ii) The level of output that maximises profit. (2 marks)

(iii) The breakeven output. (2 marks)

(b) A game between two players, A and B has the following pay off matrix:

		Player A strategies				
		A_1	A_2	A_3	A_4	A_5
Player B Strategies	B_1	0	– 4	1	2	4
	B_2	– 4	5	– 1	1	9
	B_3	13	5	3	11	9
	B_4	– 2	8	– 7	– 1	– 2

Required:

(i) The optimum strategy for each player. (4 marks)

(ii) The saddle point. (1 mark)

(iii) The value of the game. (1 mark)

(c) An accounting college has two classes, day class and evening class. From a survey conducted by the head of academics in the college, the following results were obtained:

	Classes	
	Day	**Evening**
Number of students	13	15
Average test mark (%)	45	55
Standard deviation (%)	4	5

Required:
Determine whether there is any significant difference in the average test mark between the two classes at 5% level of significance. (8 marks)

(Total: 20 marks)

QUESTION TWO

(a) A baker must decide whether to bake brown bread or white bread for a new market. Demand at the market can either be small or large with probability estimated to be 0.3 and 0.7 for brown bread and white bread respectively.

Additional information:

1. If brown bread is baked and demand proves to be high, the baker may choose not to expand (pay off = Sh.350,000) or to expand (pay off = Sh.420,000).
2. If brown bread is baked and demand is low, there is no reason to expand and the payoff is Sh.310,000.
3. If white bread is baked and demand proves to be low, the choice is to do nothing (Sh.90,000) or to stimulate demand through local advertising. The response to advertising may be either modest or sizeable, with their probabilities estimated to be 0.4 and 0.6 respectively. If it is modest, the pay off is estimated to be Sh.50,000; the pay off grows to Sh.340,000 if the response is sizeable.
4. If white bread is baked and the demand turns out to be high, the payoff is Sh.1,400,000.

Required:

(i) A decision tree showing the payoff and expected monetary value of each alternative decision. (6 marks)

(ii) Advise the management of the bakery on the best product to introduce into the market. (2 marks)

(b) In a choral music competition, 9 contestants were awarded marks in percentage using a music scoring grid by two assessors. The results obtained were given as shown in the table below:

	Marks in % by:	
Contestant	**1st Assessor**	**2nd Assessor**
A	72	76
B	82	80
C	79	78
D	70	73
E	67	70
F	81	85
G	78	69
H	75	83
I	65	68

Required:

(i) The rank correlation coefficient. Interpret your results. (4 marks)

(ii) Coefficient of determination. (1 mark)

(c) In a certain hospital, the arrival rate of patients into the outpatient department is 3 patients per hour and 4 patients are normally attended per hour.

Required:

(i) Service rate. (1 mark)

(ii) Length of queue. (1 mark)

(iii) Length of the system. (1 mark)

(iv) The time a patient takes being actually attended. (2 marks)

(v) The probability that there are more than six patients in the outpatient hospital department. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Dolce Ltd. is in the process of launching a new product into the market. Three variables are uncertain; selling price, variable cost and sales volume.

The following information is provided:

Selling price (Sh)	**Probability**
600	0.30
700	0.50
800	0.20
Variable cost (Sh.)	**Probability**
300	0.40
400	0.50
500	0.10
Sales volume (units)	**Probability**
40,000	0.30
50,000	0.50
60,000	0.20

The following random numbers have been provided:

44, 84, 82, 50, 85, 40, 96, 88, 16, 16, 97, 92, 44, 82, 39, 33, 83, 42, 16, 07, 77, 66, 50, 20, 50, 95, 83, 39, 58, 44, 77, 11, 08, 38, 89, 45, 09, 99, 81, 97, 50, 83.

Required:

The average contribution of Dolce Ltd. using Monte Carlo simulation with 10 simulations. (10 marks)

(b) The production manager of Sweet Ltd. is concerned with the fluctuating indirect labour cost in relation to the labour hours worked by the employees.

The following data was collected for the past 12 months.

Month	**Labour hours "000"**	**Indirect labour cost Sh."000"**
January	48	963
February	68	752
March	94	1,032
April	82	1,316
May	46	710
June	78	1,180
July	96	1,456
August	60	770
September	72	1,004
October	62	1,211
November	88	917
December	68	1,190

Required:

Using the ordinary least squares method:

(i) Formulate the indirect cost function. (5 marks)

(ii) Compute the indirect labour cost for 120 labour hours. (2 marks)

(iii) Calculate the coefficient of determination. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the following terms as used in linear programming:

(i) Infeasibility. (2 marks)

(ii) Unboundedness. (2 marks)

(b) A training institution has four lecturers represented as L1, L2, L3 and L4. The Head of department wishes to assign them to handle three topics in quantitative analysis; T1, T2 and T3. This will be done based on competency which is measured in terms of mastery of subject matter and personal preference on the time schedule while satisfying policies and provisions of the institution.

All of the lecturers have taught the topics in the past and have been evaluated with the following scores in the three different topics as follows:

		Topics		
		T1	**T2**	**T3**
Lecturers	**L1**	42	16	27
	L2	48	40	25
	L3	50	18	36
	L4	58	38	60

Required:

(i) The optimal assignment for these three topics. (4 marks)

(ii) The maximum score. (2 marks)

(iii) The lecturer that will not be assigned any topic. (1 mark)

(c) The data given below shows the profits in shillings million made by an economic sector in your country during the various quarters of the given years.

	Profits in quarters			
Year	**Q1**	**Q2**	**Q3**	**Q4**
2016	83	260	215	293
2017	105	383	248	553
2018	140	430	323	588
2019	168	503	340	755

Required:

(i) 3 quarter moving average of the series. (5 marks)

(ii) The deseasonalised profit of the economic sector using the additive model. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) With reference to analysis of variances (ANOVA) tests:

(i) Distinguish between one-way and two-way ANOVA tests. (2 marks)

(ii) Outline four assumptions of two-way ANOVA tests. (4 marks)

(iii) Explain the difference between ANOVA tests and T-tests. (4 marks)

(b) In the context of critical path analysis (CPA) method:

(i) Discuss two strengths and two weaknesses of CPA method. (4 marks)

(ii) Explain three practical applications of CPA method. (6 marks)

(Total: 20 marks)

.....

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

THURSDAY: 28 November 2019. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Business analytics is today emerging as a critical component of driving and sustaining business growth, particularly in the face of rising competition and other market dynamics.

Required:
In the context of the above statement, describe what "business analytics" entails. (6 marks)

(b) Six consultants work for XYZ Ltd. A consultant has a 20% chance of being absent from work in a given day. The company needs to establish the probability of more than two consultants being absent from work.

Required:
Compute the above probability of absence assuming:

(i) A binomial distribution. (4 marks)

(ii) A Poisson distribution. (4 marks)

(c) A small economy has two sectors, X_1 and X_2 producing a single product for their internal and external demand (in units), as summarised in the following transaction matrix.

Production sector	Purchase sector		Consumer demand
	X_1	X_2	
X_1	500	800	200
X_2	600	1,400	400

The projected consumer demand changes to 400 units and 800 units for sector X_1 and X_2 respectively.

Required:
The required gross output of each sector in order to meet the new demand. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) The profit function (in Sh. "000") for a given company is given as:

Profit = $10x - x^2 - 5$
Where x represents time in months.

Required:

(i) Cumulative profit in the break-even time interval. (4 marks)

(ii) The best time to end the production. (2 marks)

(iii) The total profit based on your result in (a) (ii) above. (1 mark)

(b) A manufacturing company is testing a plant for acceptance. For the plant to be accepted, the mean reflectometer reading should be 19.5 and above.

A random sample of 25 readings is taken and found to have a mean of 19.7 with a standard deviation of 1.5

Required:
Test at 95% level of confidence whether the company should accept the new plant. (3 marks)

(c) Explain two advantages and two disadvantages of decision trees as used in decision theory. (4 marks)

(d) A bank teller can open new accounts at an average rate of 3 accounts per hour. Customers requiring to open an account arrive at an average rate of 2 customers per hour.

The management of the bank has established a single channel single phase queuing system.

Required:
(i) The average number of customers in the system. (2 marks)

(ii) The average time spent by a customer in the system. (2 marks)

(iii) The average number of customers in the queue. (1 mark)

(iv) The utilisation factor of the service utility. (1 mark)
(Total: 20 marks)

QUESTION THREE
(a) In the context of time series analysis, describe three differences between "additive" and "multiplicative" models. (6 marks)

(b) A small business is interested in establishing the relationship between the number of hits on its website (measured by number of visitors that have used the main menu) and the amount spent in website promotion (in Sh. "000").

The table below gives the figures for the last six months:

Month	Website hits	Website promotion (Ksh. "000")
1	25	1.0
2	24	1.2
3	56	1.6
4	54	1.4
5	55	1.2
6	58	1.8

Required:
(i) Illustrate, using a graph, the number of website hits against the amount spent in website promotion.

Comment on any relationship between website hits and the extent of promotion. (4 marks)

(ii) Calculate the correlation coefficient and give an interpretation to its value. (5 marks)

(iii) Determine the regression line. (5 marks)
(Total: 20 marks)

QUESTION FOUR

(a) (i) Explain the meaning of a "transition matrix". (2 marks)

(ii) Outline two features of a transition matrix. (2 marks)

(b) A chemical reaction in a processing plant is given by:

$K = T^2 P^{-1}$, where:

T is an input matrix.

P^{-1} is an inverse of matrix P.

K is an output matrix.

Given that $T = \begin{pmatrix} 2 & 4 \\ 2 & 0 \end{pmatrix}$ and

$P = \begin{pmatrix} 1 & 7 \\ 0 & 4 \end{pmatrix}$

Required:
Calculate the output matrix K. (4 marks)

(c) Kikwetu Company Ltd. is the sole producer of 3 cosmetic products; Meta, Nzuri and Safi which currently have a market share of 40% , 40% and 20% respectively. Each week, some brand switching takes place. Of those who bought Meta the previous week, 60% buy it again while 20% switch to Nzuri and 20% to Safi. Of those who bought Nzuri the previous week, 50% buy it again while 40% switch to Meta and 10% to Safi. Of those who bought Safi, 80% remain loyal while 10% switch to Meta and 10% to Nzuri.

Required:

(i) Construct a probability transition matrix of the switching probabilities. (2 marks)

(ii) Construct a vector to represent the initial market share in percentages. (1 marks)

(iii) Calculate a new market share a week after the current market share. (3 marks)

(d) Simulation models have various applications in business.

Required:
Discuss how simulation models can be applied in:

(i) Predicting business outcome. (3 marks)

(ii) Managing business risks. (3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) A businessman has three alternatives open to him, each of which can be followed by any of the five payoff conditional possible events (in millions of shillings) as given below.

	Pay off conditional on events				
Alternative	**E_1**	**E_2**	**E_3**	**E_4**	**E_5**
A	6	2	-2	-12	4
B	-6	-3	10	16	0
C	12	8	4	0	6

Required:
Advise the businessman on the best alternative under:

(i) Maximin criterion. (1 mark)

(ii) Maximax criterion. (1 mark)

(iii) The Hurwitz criterion, assuming a degree of optimism of 0.6. (1 mark)

(iv) Laplace criterion. (1 mark)

(b) A manufacturing firm produces two products, X and Y. The standard revenues and costs per unit of the products are as follows:

	Product X		Product Y	
	Sh.	Sh.	Sh.	Sh.
Selling price		400		360
Variable costs:				
Material B (Sh.20 per kg)	80		80	
Direct labour (Sh.16 per hour)	64		32	
Packing (Sh.24 per hour)	24		48	
Other variables	152	(320)	140	(300)
Fixed overhead (Sh.14 per hour direct labour)		(56)		(28)
Standard profit		24		32

Additional information:

1. Packaging is a separate automated task and the cost relates to materials and electricity.
2. The maximum available inputs per week are limited as follows:

Material B	240 kg
Direct labour	200 hours
Packaging time	100 hours

3. The profit of the company could be increased by increasing the selling price of product Y.

Required:

(i) Formulate and solve the above Linear programming model graphically. (6 marks)

(ii) Determine the maximum selling price of Product Y at which the solution in (b) (i) above would still remain optimal. (2 marks)

(c) John Wekesa is the manager at Mikate Bakers Ltd. He intends to establish the cost of each bread. He gathers the following data on the total cost of each day's production for the last 10 days as shown in the table below:

Day	Number of units of bread (in hundreds)	Total cost (Sh."000")
1	45	46
2	42	43.2
3	55	46.6
4	43	48
5	60	56.4
6	40	44.8
7	48	46.2
8	53	50.6
9	36.6	40.2
10	34	33

Required:

(i) The total cost function using the least squares method. (6 marks)

(ii) If each bread is sold at Sh.50, predict the break-even number of units of bread. (2 marks)

(Total: 20 marks)

.....

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
[illegible]											
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
[illegible]											
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
[illegible]											
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
[illegible]											
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 24 May 2019. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) The marginal revenue and average cost functions of Biashara Limited are given as follows:

$MR = 40q - 3q^2$ (in Sh. million)

and

$AC = 2q - 10 + 25/q$ (in Sh. million)

Where: MR is the marginal revenue function.
q is the quantity of units produced and sold.
AC is the average cost function.

Required:

(i) The profit function. (2 marks)

(ii) The maximum profit. (4 marks)

(b) A salesman earns a fixed monthly basic salary and a commission that is directly proportional to the number of units sold in the month. During the months of February 2019 and March 2019, the salesman's total earnings were Sh.60,000 and Sh.70,000 respectively. The number of units sold by the salesman in the months of February 2019 and March 2019 were 100 and 250 respectively. During the month of April 2019, the salesman sold 400 units.

Required:

Using matrix algebra, determine:

(i) The fixed monthly basic salary of the salesman. (2 marks)

(ii) Commission earned per unit sold. (2 marks)

(iii) Total earnings of the salesman in the month of April 2019. (2 marks)

(c) A medium sized commercial bank has a clientele of 200 active customers. The bank operates three different types of accounts namely; current account, savings account and fixed deposit account. Information obtained from the bank indicates that:

- 84 customers operate savings accounts.
- 109 customers operate current accounts.
- 106 customers operate fixed deposit accounts.
- 45 customers operate both savings and current accounts.
- 36 customers operate both savings and fixed deposit accounts.
- 43 customers operate both fixed deposit and current accounts.

Required:

(i) Present the above information in a venn diagram. (3 marks)

(ii) The probability that a customer selected at random operates all the three types of accounts. (4 marks)

(iii) The probability that a customer selected at random operates only two types of accounts. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) Enumerate four assumptions of:

(i) A normal distribution. (4 marks)

(ii) A binomial distribution. (4 marks)

(b) A certain store has three cashiers serving customers at any given point in time. Each of the cashiers can serve on average 5 customers per hour. The arrival rate of customers averages 12 customers per hour.

Required:

The probability that there are no customers in the queuing system at a given point in time. (4 marks)

(c) A manufacturing company intends to introduce a new product into the market. Three products have been proposed namely; P_1, P_2 and P_3. The company can only introduce one of the three products. The following are the estimates of the probabilities and annual profits of the three products at three given states of demand, namely; high, moderate and low.

		Annual profit (Sh."000")		
State of demand	**Probability**	**P_1**	**P_2**	**P_3**
High	0.35	15,000	34,000	22,000
Moderate	0.40	25,000	30,000	15,000
Low	0.25	(5,000)	(3,000)	8,000

Required:

(i) A decision tree showing the payoff and expected monetary value of each alternative action. (6 marks)

(ii) Advise the management of the company on the best product to introduce into the market. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms as used in network planning and analysis:

(i) Free float. (1 mark)

(ii) Total float. (1 mark)

(iii) Project crashing. (1 mark)

(b) (i) In relation to hypothesis testing and estimation, distinguish between "null hypothesis" and "alternative hypothesis". (2 marks)

(ii) Beta Limited deals in the manufacture of a detergent named "safi". A recent survey undertaken to determine the percentage of residents who use "safi" revealed that out of 500 residents selected at random, only 10% used "safi". In order to increase the usage of "safi" amongst the residents, the company undertook an advertising campaign that cost Sh.2.5 million. A survey undertaken after the campaign revealed that out of 600 residents selected at random, 15% used "safi".

Required:

Determine whether the advertising campaign increased the usage of "safi" amongst the residents. (Use a significance level of 5%). (5 marks)

(c) Two competing companies, A and B, that deal in the sale of computers, have an equal share of the market. Both companies intend to increase their market share through adoption of three different media of advertisement, namely: newspaper, radio and television. The payoff table for the two companies, showing the gain or loss of customers from adoption of the different media of advertisement is as shown below:

		Company B	
Company A	**Newspaper**	**Radio**	**Television**
Newspaper	40	50	-17
Radio	10	25	-10
Television	100	30	60

Required:

(i) The optimal strategies for companies A and B. (8 marks)

(ii) The value of the game. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Highlight two differences between "transportation" and "assignment" models of linear programming. (4 marks)

(b) Summarise three applications of shadow prices in decision making. (3 marks)

(c) The table below shows the number of years of experience of ten salespersons and the respective mean monthly sales realised by the salespersons.

Salesperson	**Years of experience**	**Mean monthly sales (Sh.)**
1	6	180,000
2	4	150,000
3	2	80,000
4	10	500,000
5	7	190,000
6	4	100,000
7	6	200,000
8	7	220,000
9	12	600,000
10	8	200,000

Required:

(i) The coefficient of correlation. Interpret your result. (7 marks)

(ii) Using ordinary least squares method, predict the mean monthly sales that would be realised by a salesperson having 15 years of experience. (6 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Outline four merits of using the project evaluation and review technique (PERT) to plan and analyse a project in an organisation. (4 marks)

(b) A food processing company intends to install a computerised order processing system. The activities to be carried out during the installation of the system and their time estimates are given below:

	Time estimates (days)		
Activity	**Optimistic time**	**Most likely time**	**Pessimistic time**
A	7	17	27
B	5	11	23
C	3	8	19
D	23	31	45
E	9	21	39
F	9	11	25
G	2	5	14
H	9	10	17

The above time estimates were analysed using a computer and the results of the analysis were as follows:

Activity	Earliest start time (days)	Latest start time (days)	Earliest finish time (days)	Latest finish time (days)
A	0	0	17	17
B	17	17	29	29
C	29	43	38	52
D	29	29	61	61
E	38	52	60	74
F	61	61	74	74
G	61	79	67	85
H	74	74	85	85

Required:

(i) The expected completion time and variance of each of the activities. (8 marks)

(ii) The total float of each activity. (4 marks)

(iii) The expected completion time and variance of the project. (2 marks)

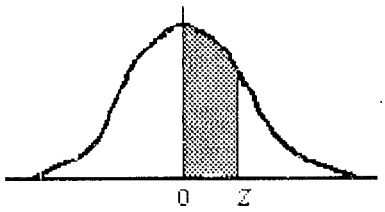
(iv) The 95% confidence interval for the project's completion time. (2 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 30 November 2018. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Explain the following terms as used in decision theory:

(i) Opportunity loss. (1 mark)

(ii) Expected value of perfect information. (1 mark)

(b) Outline three assumptions of the transportation model. (3 marks)

(c) A company operates under two departments, P and Q. Details relating to a sample of employees working in the two departments has been provided as follows:

	Department P	**Department Q**
Number of employees	29	24
Average monthly salary	Sh.260,000	Sh.310,000
Standard deviation	Sh.25,000	Sh.30,000

Required:

Determine whether there is any significant difference between the average monthly salaries of employees working in the two departments. (Use a significance level of 5 per cent). (6 marks)

(d) Bidii College offers three courses namely; Accounting, Computing and Driving. The college has a total population of 500 students. Data obtained from the college revealed the following:

329 Students were undertaking Accounting course.
186 Students were undertaking Computing course.
295 Students were undertaking Driving course.
83 Students were undertaking both Accounting and Computing courses.
217 Students were undertaking both Accounting and Driving courses.
63 Students were undertaking both Computing and Driving courses.

Required:

(i) Present the above information in a Venn diagram. (3 marks)

(ii) The number of students undertaking all the three courses. (4 marks)

(iii) The number of students undertaking only one course. (2 marks)

(Total: 20 marks)

QUESTION TWO

(a) ABC Limited manufactures and sells electronic calculators whose marginal cost function is given by:

$$MC = x - 100 \text{ (in thousands of shillings)}$$

Where: MC is the marginal cost function.
x is the number of electronic calculators produced and sold.

The fixed cost of production amounts to Sh.250,000. The total revenue function is estimated to be quadratic in nature.

The table below shows the sales revenue realised by the company at three different production levels:

Number of electronic calculators produced and sold (x)	Sales revenue (Sh."000")
20	1,600
40	3,200
60	4,800

Required:

(i) The total profit function. (6 marks)

(ii) The maximum profit. (2 marks)

(b) X Limited, Y Limited and Z Limited deal in the production of detergents. On 1 January 2017, the three companies introduced a similar new detergent in the market. Prior to introduction of the new detergent, the three companies had an equal share of the market. A survey conducted on the market shares of the three companies as at 31 December 2017 revealed the following:

1. X Limited had retained 90 per cent of its customers but had lost 3 per cent and 7 per cent of its customers to Y Limited and Z Limited respectively.
2. Y Limited had retained 75 per cent of its customers but had lost 10 per cent and 15 per cent of its customers to X Limited and Z limited respectively.
3. Z Limited had retained 80 per cent of its customers but had lost 5 per cent and 15 per cent of its customers to X Limited and Y Limited respectively.
4. There were no significant changes in the buying habits of the customers during the year.

Required:

(i) The market shares of the three companies as at 31 December 2018. (3 marks)

(ii) The long run market shares of the three companies. (9 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms as used in hypothesis testing:

(i) Level of significance. (1 mark)

(ii) Region of rejection. (1 mark)

(b) Summarise three factors that determine the size of the Pearson product moment correlation coefficient. (6 marks)

(c) The following data were obtained from the records of a certain company, relating to the year 2018:

Month	Total overhead costs – Y (Sh.)	Direct labour hours – X
January	14,250	856
February	13,000	536
March	13,000	640
April	12,500	600
May	13,250	680
June	13,750	808

Required:

(i) The least squares regression function relating the direct labour hours to the total overhead cost. (7 marks)

(ii) The coefficient of determination. (4 marks)

(iii) Comment on the results obtained in (c) (ii) above. (1 mark)

(Total: 20 marks)

QUESTION FOUR

The data below represent the number of students enrolled in a certain college over a four year period:

	Number of students enrolled			
	Quarter			
Year	1	2	3	4
2015	70	100	80	60
2016	50	40	120	80
2017	90	70	70	40
2018	60	100	130	-

Required:

(a) The adjusted seasonal component for each of the four quarters, using the multiplicative model. (12 marks)

(b) Estimate the enrollment of students in each of the four quarters of year 2019 using the simple least squares method. (8 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Explain the following terms as used in probability theory:

(i) Mutually exclusive events. (1 mark)

(ii) Independent events. (1 mark)

(iii) Joint probability. (1 mark)

(iv) Conditional probability. (1 mark)

(b) The manager of a certain project has identified the following information relating to the project:

Activity	Immediate predecessor (s)	Duration (weeks)	Probability
A	-	3	0.25
		4	0.50
		5	0.25
B	-	4	0.15
		5	0.30
		6	0.20
		7	0.20
		8	0.15
C	A	1	0.20
		3	0.65
		5	0.15
D	B, C	4	0.80
		5	0.20
E	D	3	0.15
		4	0.25
		5	0.25
		6	0.35
F	D	5	0.20
		7	0.80
G	E, F	2	0.50
		3	0.50

Required:

(i) A network diagram for the project. (6 marks)

(ii) The expected duration of the project. (2 marks)

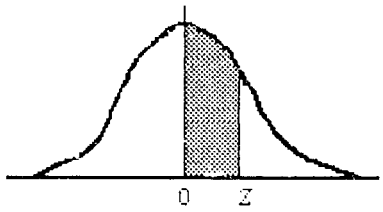
(iii) Simulate the durations of the project on the basis of two runs. (8 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 25 May 2018. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Enumerate four assumptions that are implied in the application of the linear programming model. (4 marks)

(b) The unit price and total cost functions associated with the production and sale of a certain electric component are given by the following equations:

$P = 100 - 5q$

and

$TC = q^2 + 4q + 300$ (in thousands of shillings)

Where:

P is the unit price of the electric component.

q is the number of electric components produced and sold.

TC is the total cost.

Required:

(i) The number of electric components that would maximise profit. (4 marks)

(ii) The maximum profit. (2 marks)

(iii) The maximum total revenue. (2 marks)

(c) A certain firm has three main departments namely; steel, motor vehicles and construction. The three departments are interdependent. Each unit of output from the steel department requires 0.2, 0.3 and 0.4 units from steel, motor vehicles and construction departments respectively. Each unit of output from motor vehicles department requires 0.2, 0.4 and 0.2 units from steel, motor vehicles and construction departments respectively. A unit of output from the construction department requires 0.3, 0.4 and 0.1 units from steel, motor vehicles and construction departments respectively. The final demand of the firm comprises 20 million, 50 million and 30 million units of output from steel, motor vehicles and construction departments respectively.

Required:

(i) The technical coefficient matrix. (1 mark)

(ii) The total output of each department given that the Leontief's inverse matrix is as provided below:

$$\frac{1}{0.192}\begin{pmatrix} 0.46 & 0.24 & 0.26 \\ 0.43 & 0.60 & 0.41 \\ 0.30 & 0.24 & 0.42 \end{pmatrix}$$

(3 marks)

(iii) The change in the total output of the construction department, given that the final demand of steel department decreases by 2 million units and that of motor vehicles department increases by 10 million units whereas that of the construction department does not change. (4 marks)

(Total: 20 marks)

QUESTION TWO

(a) (i) Distinguish between a "single server queuing model" and a "multiple server queuing model". (2 marks)

(ii) Highlight two assumptions of the queuing theory. (2 marks)

(b) Outline three advantages and three disadvantages of the simulation model as used in quantitative analysis. (6 marks)

(c) Mwanaisha Ali sells tree seedlings at Mavuno market. A random sample of 9 of the seedlings had the following height in centimetres:

64 62 65 63 68 69 65 63 65.

Required:
A 95 per cent confidence interval of the population mean height of the seedlings. (4 marks)

(d) BC Limited operates two factories namely; X_1 and X_2. Both factories deal in the production of a product named "Nguzo". The joint cost function for production of product "Nguzo" is given by:

$$C = f(q_1,q_2) = 2q_1^2 + q_1q_2 + q_2^2 + 500$$

Where:

C = Joint cost function of factories X_1 and X_2
q_1 = Quantity produced by factory X_1
q_2 = Quantity produced by factory X_2

BC Limited has received an order to produce 200 units of product "Nguzo".

Required:
The quantities of product "Nguzo" that should be produced by factories X_1 and X_2 respectively in order to minimise cost. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the difference between the following sets of terms as used in hypothesis testing and estimation:

(i) "Type I error" and "type II error". (2 marks)

(ii) "One tailed test" and "two tailed test". (2 marks)

(b) Faida Limited deals in the manufacture and sale of a product named "Big". The company sells the product in two of its distribution outlets, A and B.

The data below relate to a random survey of monthly mean sales of the product in the two outlets:

Outlet	Monthly mean sales (Sh."000")	Standard deviation (Sh."000")	Sample size
A	795	50	200
B	810	70	175

Required:
Test at a 5 per cent level of significance, whether there is a significant difference in the monthly mean sales of the two outlets. (6 marks)

(c) A manufacturing company is considering production of one of the three different types of pens, P_1, P_2 and P_3. The fixed and variable costs of producing the pens are as given below:

Type of pen	Fixed cost (Sh.)	Variable cost (Sh.)
P_1	2,000,000	100
P_2	3,200,000	80
P_3	6,000,000	60

The demand of the pens under three different states of demand is provided below:

State of demand	Number of pens
Low	250,000
Moderate	1,000,000
High	1,500,000

The unit selling price of the pens is Sh.200.

Required:

(i) The payoff table of the company. (6 marks)

(ii) The type of pen to produce using the maximin criterion. (1 mark)

(iii) The type of pen to produce using the maximax criterion. (1 mark)

(iv) The type of pen to produce using the minimax regret criterion. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Define the following terms as used in game theory:

(i) Mixed strategy. (1 mark)

(ii) Value of the game. (1 mark)

(b) An intelligence test was undertaken by ten salesladies of a certain company.

The table below shows the intelligence test scores in percentages and the mean weekly sales in thousands of shillings made by the salesladies:

Saleslady	1	2	3	4	5	6	7	8	9	10
Intelligence test score (%)	40	70	50	60	80	50	90	40	60	60
Weekly sales (Sh. "000")	50	120	80	100	80	50	110	60	90	60

Required:

The coefficient of correlation. Interpret your result. (8 marks)

(c) A firm manufactures two products, X and Y, subject to constraints on three raw materials, RM1, RM2 and RM3. The objective of the firm is to select a product mix that will maximise weekly profit. Each unit of product X earns a profit of Sh.2 whereas each unit of product Y earns a profit of Sh.1.

Details of the raw materials required for the production of products X and Y are as given below:

Raw material	**Maximum quantity (units)**	**Quantity required per unit of production**	
		Product X	**Product Y**
RM1	27	3	0
RM2	30	0	2
RM3	20	1	1

Required:

(i) A linear programming model of the firm. (4 marks)

(ii) The optimum product mix using the simplex method. (6 marks)

(Total: 20 marks)

QUESTION FIVE

(a) An electricity company has established that the weekly number of occurrences of lightning striking transformers follows a Poisson distribution with a mean of 0.4 per week.

Required:

(i) The probability that no transformer will be struck by lightning in a week. (3 marks)

(ii) The probability that at most two transformers will be struck by lightning in a week. (5 marks)

(b) The following information relates to a certain construction project:

Activity	Preceding activity	Time estimates (weeks)		
		Most optimistic	Most likely	Most pessimistic
A	-	2	4	12
B	-	10	12	26
C	A	8	9	10
D	A	10	15	20
E	A	7	7.5	11
F	B, C	9	9	9
G	D	3	3.5	7
H	E, F, G	5	5	5

Required:

(i) The network diagram for the project. (8 marks)

(ii) The critical path. (1 mark)

(iii) The probability of completing the project within a 30 - week duration. (3 marks)

(Total: 20 marks)

.....

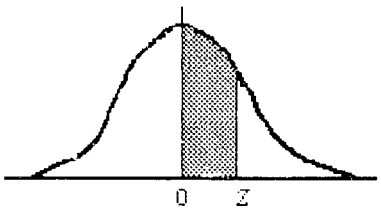
t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

kasneb

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 1 December 2017. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Outline four applications of mathematical functions in business. (4 marks)

(b) Highlight the four components of a time series. (4 marks)

(c) A survey was conducted on 800 households to determine their preference for three consumer goods, namely Fex, Gex and Mex. The results of the survey were as follows:

230 households preferred Fex.
245 households preferred Gex.
325 households preferred Mex.
30 households preferred all the three goods.
70 households preferred Fex and Mex.
110 households preferred Fex only
185 households preferred Mex only.

Required:

(i) Present the above information in a venn diagram. (4 marks)

(ii) The number of households that preferred Fex and Gex. (1 mark)

(iii) The probability that a household selected at random does not prefer any of the three goods. (1 mark)

(d) Soda Baridi Limited has a computerised customer billing system. Customers' accounts are classified as being paid, delinquent or bad debt. The company has a total of 1,500,000 customer accounts. A computer program was developed to display transition of accounts among the three categories. The output from the program is summarised below:

		To		
		Paid	**Delinquent**	**Bad debt**
	Paid	285,000	15,000	0
From	**Delinquent**	20,000	700,000	30,000
	Bad debt	0	0	450,000

The above transitions took place between 31 December 2015 and 31 December 2016.

Required:

The percentage of customers that will be in each of the three categories of accounts as at 31 December 2017. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) Enumerate three circumstances under which the Poisson distribution is most applicable. (3 marks)

(b) A company produces two types of electric components whose information has been provided to you as follows:

	Component X	Component Y
Mean life in hours	1,600	1,528
Standard deviation in hours	132	149
Sample size	120	110

Required:
Determine whether the quality of the two types of electric components differ significantly. (Use a significance level of 95%). (3 marks)

(c) A survey conducted on citizens of a certain country to determine the annual per capita income indicated that the annual income of the citizens is normally distributed with a mean of Sh.980,000 and a standard deviation of Sh.160,000. One citizen was randomly selected from the country.

Required:
The probability that the annual income of the citizen:

(i) Is greater than Sh.500,000. (2 marks)

(ii) Is greater than Sh.1,220,000. (2 marks)

(iii) Lies between Sh.852,000 and Sh.1,100,000. (2 marks)

(d) Excellent Products Limited manufactures four products, A, B, C and D, using four machines, M_1, M_2, M_3 and M_4. The total outputs of the four products from the four machines are as shown below:

		Output (units "000")			
		A	B	C	D
Machines	M_1	12	12	6	13
	M_2	18	20	22	20
	M_3	16	15	12	18
	M_4	14	12	16	12

The company intends to assign the production of each output to a particular machine.

Required:
Advise the management of Excellent Products Limited on the best assignment that will maximise production. (4 marks)

(e) The demand and total cost functions (in thousands of shillings) of a certain company that deals in the manufacture of a product name "Exe" are given as follows:

$$P = 75 - 0.18Q$$

and

$$TC = 80Q + 5Q^2 - 0.03Q^3$$

Where: P is the unit selling price.
Q is the quantity demanded in units.
TC is the total cost.

Required:

(i) The profit function. (1 mark).

(ii) The output level that would maximise profit. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) Distinguish between "regression analysis" and "correlation analysis". (2 marks)

(b) Summarise two applications of rank correlation. (2 marks)

(c) The following exponential function represents the advertising cost of a certain small enterprise:

$y = ab^x$

Where: y is the advertising cost in thousands of shillings
a, b are constants over a period of seven years.
x is the period under consideration.

The actual advertising cost of the enterprise over a seven year period is given as follows:

Year	1	2	3	4	5	6	7
Advertising cost (Sh. "000")	32	47	65	92	132	190	275

Required:

(i) The advertising cost function of the enterprise, using the normal equation. (7 marks)

(ii) The advertising cost of the enterprise in year 8. (1 mark)

(d) The management of New Era Computer Systems Limited is planning to launch a new product branded Zimsang. The fixed cost of Zimsang is Sh.80,000. However, the selling price, variable costs and annual sales volume of Zimsang are uncertain. The data below relate to product Zimsang:

Unit selling price (Sh.)	**Probability**	**Variable cost (Sh.)**	**Probability**	**Sales volume (units)**	**Probability**
60	0.25	20	0.25	40,000	0.30
80	0.45	40	0.55	60,000	0.35
100	0.30	60	0.20	100,000	0.35

Required:

Simulate the average profit of product Zimsang on the basis of 10 trials. Use the following random numbers:

81 32 60 04 46 31 67 25 24 10 40 02 39

68 08 59 66 90 12 64 79 31 86 68 82 89

25 11 98 16

(8 marks)

(Total: 20 marks)

QUESTION FOUR

(a) In a certain busy business facility, the mean arrival rate of clients is 800 clients per hour. The mean service rate is 820 clients per hour. The facility operates between 6.00 a.m. and 6.00 p.m. every day. The management of the facility are concerned about the average number of customers in the queuing system and wish to improve the facility in order to serve an average of 847 clients per hour. The cost of improving the facility amounts to Sh.18,500 per day. Each hour lost costs the facility Sh.125.

Required:

(i) The average waiting cost per day. (4 marks)

(ii) Advise the management on whether they should improve the facility. (4 marks)

(iii) Compare the probabilities that the total number of clients in the queue and those being served is greater than 17 in the existing and in the improved facilities. (4 marks)

(b) Two airlines, K and Q are interested in increasing their market shares. Airline K has three available strategies, advertising its special fare, advertising its unique features or advertising its safety record. On the other hand, Airline Q also has three available strategies; do nothing, advertise its special fare or advertise its special features.

The matrix below shows the gains and losses associated with the different available strategies in millions of shillings. Positive values favour Airline K and negative values favour Airline Q.

		Airline Q		
		Q_1	**Q_2**	**Q_3**
Airline K	**K_1**	– 30	0	– 90
	K_2	– 40	– 15	– 20
	K_3	80	20	– 50

Where:

K_1 = Advertise special fare.
K_2 = Advertise unique features.
K_3 = Advertise safety record.
Q_1 = Do nothing.
Q_2 = Advertise special fare.
Q_3 = Advertise special features.

Required:

(i) The optimal strategies for each airline. (7 marks)

(ii) The value of the game. (1 mark)

(Total: 20 marks)

QUESTION FIVE

(a) Explain the following terms as used in game theory:

(i) Saddle point. (1 mark)

(ii) Dominance. (1 mark)

(b) Suggest two areas in which advanced information technology could be used to solve quantitative analysis problems. (2 marks)

(c) The data below relate to normal duration and cost along with crash duration and cost for each activity of a certain project.

Activity	Normal duration (Days)	Crash duration (Days)	Normal cost (Sh.)	Crash cost (Sh.)
1 – 2	6	4	2,800,000	3,800,000
1 – 3	8	5	4,000,000	5,600,000
2 – 3	4	2	2,200,000	3,000,000
2 – 4	3	2	1,600,000	2,800,000
3 – 4	Dummy	-	-	-
3 – 5	6	3	1,800,000	3,200,000
4 – 6	10	6	5,000,000	7,000,000
5 – 6	3	2	1,000,000	1,600,000

The indirect cost of the project is Sh.600,000 per day.

Required:

(i) The normal duration and the corresponding total cost. (6 marks)

(ii) The minimum duration and the corresponding total cost. (8 marks)

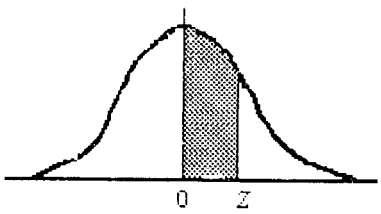
(iii) The optimum duration and the corresponding total cost. (2 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 26 May 2017. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Describe four types of sets as used in set theory. (4 marks)

(b) Explain the following terms as used in Markov analysis:

(i) Transition probability. (1 mark)

(ii) Absorbing state. (1 mark)

(c) The average revenue and marginal cost functions of a certain company are given by:

$$AR = 650 - 15x$$

and

$$MC = 9x^2 - 14x + 180$$

Where: AR is the average revenue (in Sh. million).

MC is the marginal cost (in Sh. million).

x is the level of output (in units).

The fixed cost of production is Sh. 25 million.

Required:

(i) The profit function. (3 marks)

(ii) The level of output that would maximise profit. (3 marks)

(d) Market Intelligence Research Limited carried out a study on nine households to determine the monthly income levels and the amount of expenditure incurred by the households.

The results of the study are as shown below:

Monthly Income (Sh. "000")	15	6	9	3	20	11	14	10	12
Expenditure (Sh.)	2,000	200	500	500	2,500	800	1,500	1,500	1,600

Required:

(i) The least squares regression function relating the monthly income and expenditure incurred by the households. Interpret your results. (7 marks)

(ii) The expenditure incurred by a household whose monthly income is Sh.30,000. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) Highlight four properties of a binomial experiment. (4 marks)

(b) Viwanda Limited is a company that operates in the printing industry. The company has a total of 30 machines that operate a 24 hour cycle. The probability of a machine breaking down on any given day is 0.015.

Required:

(i) The probability that exactly four machines break down in a given day, using poisson distribution. (3 marks)

(ii) The probability that exactly four machines break down in a given day, using binomial distribution. (2 marks)

(iii) Comment on the results obtained in (b)(i) and (b)(ii) above. (2 marks)

(c) ABC Limited has recently developed a new product named "Exe". The demand for "Exe" is expected to be low, medium or high with probabilities of 0.25, 0.45 and 0.30 respectively.

The product is to be manufactured at small or large scale production with the following annual profit estimates:

		Small scale production		Large scale production	
		Profit (Sh. million)	**Probability**	**Profit (Sh. million)**	**Probability**
Demand	**Low**	40	0.25	5	0.25
	Medium	140	0.45	90	0.45
	High	180	0.30	280	0.30

Required:

Advise ABC Limited on the best course of action based on the following approaches:

(i) Expected profit. (3 marks)

(ii) Minimising risk. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a) Mwangaza Limited deals in the production of electric bulbs. A random sample of 10 electric bulbs produced by the company yielded the following results on the lifetime of the bulbs:

Lifetime (hours)	4,400	4,800	3,700	3,900	5,500	4,000	3,700	4,100	4,000	5,400

The hypothetical population mean of the lifetime of the electric bulbs is given as 4,000 hours.

Required:

Test at a 5 per cent level of significance, whether there is a significant difference between the sample mean and the population mean. (8 marks)

(b) Green Furniture Limited manufactures two models of plastic chairs, C_1 and C_2 from plastic waste, using two automated machines, X and Y. The following information relates to the production of the two models of chairs for the coming year:

		C_1	C_2
Maximum sales (units)		8,000	12,000
Selling price (Sh.)		1,000	900
Machine time (hours):	X	0.5	0.3
	Y	0.4	0.45

The maximum operating hours of machines X and Y are 3,400 and 3,840 respectively. The maximum quantity of plastic waste available is 34,000 kilogrammes and each chair requires 4 kilogrammes of plastic waste. The company purchases plastic waste at Sh.50 per kilogramme. Variable machine overheads are estimated to be Sh.250 and Sh.300 per machine hour for machines X and Y respectively. All chairs produced are expected to be sold during the period. A computer generated print out of the linear programming model is as given below:

Objective function value 4,441,250.

Variable	Value	Reduced values	Objective coefficient	All increase	All decrease
C_1	4,250	0	555	261.70	65.00
C_2	4,250	0	490	65.00	157.00

Constraints	Value	Shadow Price	Right hand side constraint	Allowable increase	Allowable decrease
Plastic waste	34,000	98.125	34,000	1,733.33	6,800
Machine X	3,400	325.000	3,400	850.00	850
Machine Y	3,612.5	0	3,800	-	227.5

Required:

(i) Formulate the mathematical model for the linear programming problem. (4 marks)

(ii) The maximum contribution of C_1 and C_2. (2 marks)

(iii) Explain the effect on contribution of the availability of additional plastic waste and machine time. (2 marks)

(iv) Explain the sensitivity of the model to changes in contribution per unit of C_1 and C_2. (2 marks)

(v) The increase in contribution of Green Furniture Limited assuming that the management overcomes the plastic waste constraint. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Outline five assumptions of game theory. (5 marks)

(b) The table below shows marks scored by 8 students in Mathematics and English subjects:

Student:	1	2	3	4	5	6	7	8
Marks scored in Mathematics:	31	36	44	28	56	76	36	96
Marks scored in English:	56	46	66	46	36	26	46	76

Required:

The rank coefficient of correlation. Interpret your result. (5 marks)

(c) Pure Grain Society is considering the planting of wheat on a piece of land it recently acquired.

The data below relate to the estimated selling prices, yield and cost of planting the wheat:

Selling price per tonne (Sh."000")	Probability	Yield per acre (tonne)	Probability	Cost per acre (Sh."000")	Probability
240	0.18	70	0.09	12,000	0.14
250	0.29	75	0.16	14,000	0.22
260	0.31	80	0.24	16,000	0.36
270	0.14	85	0.38	18,000	0.26
280	0.08	90	0.13	20,000	0.02

You are provided with the following random numbers:

03 91 38 55 17 46 32 43 69 72 24 22 61 96 30 32

Required:

Using eight trials, simulate the average profit of Pure Grain Society. (10 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Enumerate five characteristics of a simple queuing system. (5 marks)

(b) Two companies, A and B, are competing for business whereby one company's gain is the other company's loss. The pay-off matrix is given as follows:

		Company B's strategies		
		B_1	B_2	B_3
Company A's strategies	A_1	7	4	1
	A_2	4	2	0
	A_3	3	-1	-2
	A_4	1	5	-3

Required:
The optimal strategy for each company. (4 marks)

(c) Ujenzi Limited has been awarded a contract to build an office block. The tasks of the building project have been analysed as follows:

Activity	Preceding activity	Duration (months)	Total cost (Sh. million)
A	-	8	100
B	-	2	75
C	A	3	135
D	A	7	70
E	B	5	160
F	C, D	9	255
G	D	2	30
H	D, E	4	90
I	G, H	3	55

The overhead costs of the project amount to Sh.5 million per month.

Required:

(i) A network diagram for the project. (5 marks)

(ii) The minimum cost of the project. (2 marks)

(iii) Ujenzi Limited has been offered a bonus of Sh.25 million if they complete the project within a period of 20 months or less. The table below shows activities that would require to be crashed and their respective total costs:

Activity	Duration (months)	Total cost (Sh. million)
A	6	125
B	1	90
D	5	85
E	3	200
F	7	275
H	2	95

Determine whether or not Ujenzi Limited should accept the bonus offer. (4 marks)
(Total: 20 marks)

.....

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 25 November 2016. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Explain the following terms as used in linear programming:

(i) Infeasibility. (1 mark)

(ii) Unboundedness. (1 mark)

(iii) Alternate optimality. (1 mark)

(b) The following information relates to product "X" which is susceptible to three types of defects; A, B and C. The probability of product "X" containing defect C depends on whether the product contains any other defects, A or B. The probabilities of the product containing the defects are as follows:

Type of defect	**Probability**
A	0.15
B	0.14
C (if it neither contains defect A nor defect B)	0.3
C (if it contains either defect A or defect B)	0.2
C (if it contains both defects A and B)	0.1

Required:

(i) The probability that product "X" contains no defect. (5 marks)

(ii) The probability that product "X" contains only one of the three defects. (4 marks)

(c) The data below show the number of students enrolled in six colleges for a certain course, before and after the course was advertised in a certain publication:

College	**Number of students before advertisement**	**Number of students after advertisement**
1	165	170
2	140	141
3	143	142
4	160	167
5	162	168
6	154	157

Required:

Using the paired t-test, determine whether the advertisement was a success at a 5 per cent level of significance.
(8 marks)

(Total: 20 marks)

QUESTION TWO

(a) Highlight four applications of Markov analysis in business. (4 marks)

(b) Faidika College offers three courses, namely; Accounting, Information Technology and Statistics. The marketing department of the college conducted a survey on 500 students to determine the number of students enrolled for each of the three courses. The results of the survey were as follows:

- 329 students were enrolled for Accounting.
- 186 students were enrolled for Information Technology.
- 295 students were enrolled for Statistics.
- 83 students were enrolled for Accounting and Information Technology.
- 217 students were enrolled for Accounting and Statistics.
- 63 students were enrolled for Statistics and Information Technology.

Required:

(i) Illustrate the above information in a venn diagram. (4 marks)

(ii) The probability that a student is enrolled for all the three courses. (1 mark)

(iii) The probability that a student is enrolled for Accounting or Statistics but is not enrolled for Information Technology. (1 mark)

(c) The following data show results of a regression run on the variations in labour cost as a function of labour hours worked in a certain company:

Regression statistics

R-squared	X_1
Multiple R	X_2
Standard error	0.7320
Observations	24

ANOVA	**Degrees of freedom (DF)**	**Sum of squares (SS)**	**Mean square (MS)**	**F-ratio**	**Significance F**
Regression	X_3	0.029	0.029	X_5	0
Residual or error	22	X_4	0.000455		
Total	23	0.04			

	Coefficients	**Standard error**	**t-statistic**	**P-value**
Intercept	0.077	X_6	11.328	0
Slope	0.826	0.103	X_7	0

Required:

(i) The missing values of X_1, X_2, X_3, X_4, X_5, X_6 and X_7. (7 marks)

(ii) A 95 per cent confidence level of the labour hours worked. (3 marks)

(Total: 20 marks)

QUESTION THREE

(a) TOC Limited, an oil prospecting company, intends to set up two oil refineries, refinery I and refinery II.

The following information relates to TOC Limited:

1. The company will produce two types of fuel; diesel and petrol, in each of the two refineries.
2. Three types of resources namely; crude oil, furnace time and mixer will be required to produce each litre of fuel.

3. The resource requirements for each of the two refineries is as follows:

Fuel per litre	Crude oil (litres)	Furnace time (hours)	Mixer (litres)
Diesel (Refinery I)	3	2	8
Petrol (Refinery I)	1	1	6
Diesel (Refinery II)	3	1	7
Petrol (Refinery II)	2	1	5

4. The daily amount of crude oil available at the two refineries are 12,000 litres and 15,000 litres for refinery I and refinery II respectively.
5. The hours of furnace time available at the two refineries are 10 hours and 4 hours for refinery I and refinery II respectively.
6. The total amount of mixer available for use at the two refineries is 80,000 litres per day.
7. The fuel is expected to be sold at Sh.170 per litre of diesel and Sh.160 per litre of petrol.
8. All fuel produced is expected to be sold to a sole distributor. It will cost Sh.80 to transport each litre of fuel from refinery I and Sh.100 from refinery II to the sole distributor.
9. Assume that crude oil cannot be transported from one refinery to another.

Required:
Formulate a linear programming model to maximise TOC Limited's revenue, assuming that only transport cost is variable. (7 marks)

(b) The following data show quarterly production of oranges by a certain large scale farmer in thousands of kilogrammes:

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2012	250	200	180	300
2013	330	280	260	380
2014	410	370	340	460
2015	478	-	-	-

Required:
(i) The adjusted seasonal component for the four quarters using the additive model. (8 marks)

(ii) The deseasonalised production data for each quarter. (4 marks)

(iii) Explain the significance of the deseasonalised data. (1 mark)

(Total: 20 marks)

QUESTION FOUR

(a) Enumerate four limitations of linear programming models. (4 marks)

(b) Summarise four decision criteria used in decision making under uncertainty. (4 marks)

(c) An electronics company sells programmable calculators at a unit price of Sh.100. Studies indicate that the company can sell additional 100 calculators per year for Sh.5 decrease in unit price and 100 calculators per year less for Sh.5 increase in unit price. The company currently sells 3,000 calculators per year. The cost function of the company is assumed to be linear with a fixed cost of Sh.10,000 and variable cost of Sh.65 per calculator.

Required:
(i) The price and quantity that would maximise profit. (4 marks)

(ii) The maximum profit. (1 mark)

(d) A barber shop has a total of 10 available seats for customers. The inter-arrival times for customers are exponentially distributed with an average of 20 customers arriving each hour. Any prospective customer who finds all the seats occupied does not wait for service but instead leaves. The barber takes an average of 12 minutes to cut each customer's hair. Hair cut time duration is exponentially distributed.

Required:

(i) The average number of hair cuts that will be completed by the barber each hour. (4 marks)

(ii) The average time each customer will spend at the barber shop. (3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Outline five limitations of game theory. (5 marks)

(b) The data below relate to activities of a certain project that is to be undertaken by Ujuzi Consultancy Company:

Activity	Preceding activity	Time (weeks) Optimistic	Most probable	Pessimistic
A	-	1.5	2.0	2.5
B	A	2.0	2.5	6.0
C	-	1.0	2.0	3.0
D	C	1.5	2.0	2.5
E	B,D	0.5	1.0	1.5
F	E	1.0	2.0	3.0
G	B,D	3.0	3.5	7.0
H	G	3.0	4.0	5.0
I	F,H	1.5	2.0	2.5

Required:

(i) A network diagram of the project. (8 marks)

(ii) The expected completion time of the project. (2 marks)

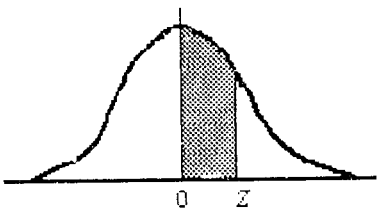
(iii) The probability that the project will be completed between 13 weeks and 17 weeks. (5 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 27 May 2016. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Explain four differences between the project evaluation and review technique (PERT) and the critical path analysis (CPA). (8 marks)

(b) A certain audit firm has two categories of employees, auditors and assistant auditors. The total monthly salary of 1 auditor and 5 assistant auditors amount to Sh.456,755 whereas the total monthly salary of 3 auditors and 9 assistant auditors amount to Sh.985,005. The firm has a total of 6 auditors and 14 assistant auditors. The employees contribute 12 per cent of their monthly salaries towards their sacco society.

Required:

(i) The monthly salary of an auditor and an assistant auditor, using matrix algebra. (4 marks)

(ii) The employees' total monthly contribution towards their sacco society. (1 mark)

(c) Shujaa Limited deals in the manufacture of a product named "Zed". The product "Zed" is produced on order and the company does not keep inventory of the product. The demand and total cost functions (in thousands of shillings) of the company are given as follows:

$P = 190 - q$

and

$TC = q^2 + 10q + 500$

Where: P is the unit selling price.
q is the quantity demanded in units.
TC is the total cost.

Required:

(i) The maximum profit of the company. (6 marks)

(ii) The output level that would maximise total revenue. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) Distinguish between a "univariate function" and a "multivariate function". (2 marks)

(b) The mean weight of 500 packaging tins from a production process are normally distributed with a mean weight of 151 grammes and a standard deviation of 15 grammes.

Required:

(i) The number of packaging tins that weigh between 120 grammes and 155 grammes. (4 marks)

(ii) The number of packaging tins that weigh more than 185 grammes. (3 marks)

(c) The following data were obtained from the records of Kiwandani Limited for the year 2015:

Month	Total overhead cost (y) (Sh.)	Director labour hours (x)
January	16,250	1,056
February	15,000	736
March	15,000	840
April	14,500	800
May	15,250	880
June	15,750	1,008

Required:

(i) The least squares regression function relating direct labour hours and total overhead cost. (7 marks)

(ii) The coefficient of determination. Comment on your result. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Explain the following terms as used in game theory:

(i) Pay-off. (1 mark)

(ii) Value of a game. (1 mark)

(b) Highlight eight steps followed in the simulation process. (8 marks)

(c) The table below shows the actual sales and target sales of eight sales agents for the year 2015 in millions of shillings.

Sales agent	1	2	3	4	5	6	7	8
Actual sales (y)	45	41	50	56	60	42	43	52
Target sales (x)	40	27	45	38	52	35	29	44

Required:

The Spearman's rank correlation coefficient. Interpret your result. (4 marks)

(d) A cashier at a departmental store can serve on average 24 customers per hour. The arrival rate of customers averages 20 customers per hour. The departmental store applies a single channel queuing system.

Required:

(i) The probability that the cashier is idle. (2 marks)

(ii) The average number of customers in the queuing system. (2 marks)

(iii) The average time a customer spends in the queue waiting to be served. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Viwanda Limited deals in the production of a product named "Nguvu". The production cost of the product is Sh.500 per unit (excluding packaging cost). The product is sold at Sh.1,000 per unit. The company is considering the purchase of one out of three different packaging systems. The cost data for the three packaging systems are as follows:

Packaging system	Purchase cost Sh. "000"	Variable cost per unit of product Sh. "000"	Scrap value Sh. "000"
A	100	1.50	10
B	200	1.00	20
C	400	0.50	40

All the three packaging systems have a useful life of one year after which they would be sold at their estimated scrap values. The probability distribution for the demand for product "Nguvu" is as provided below:

Demand (units)	Probability
100	0.3
200	0.6
400	0.1

Required:
Recommend the packaging system that should be purchased by Viwanda Limited. (8 marks)

(b) Farm Produce Limited is a producer and distributor of maize flour. The company owns milling plants in Eldoret, Nanyuki and Narok towns. The milling plants have not been able to meet the demand orders of the company's distribution offices located in Mombasa, Kisumu, Nairobi and Isiolo towns. The company is considering the construction of a new milling plant either in Nakuru town or Meru town, in order to expand its production capacity.

The data below relate to the company's production and demand requirements.

Milling plant	Monthly output (units)	Unit production cost (Sh.)
Eldoret	30,000	96
Nanyuki	12,000	100
Narok	28,000	104

Distribution office	Monthly demand (units)
Mombasa	20,000
Kisumu	24,000
Nairobi	30,000
Isiolo	18,000

Additional information:

1. The estimated unit production costs in Nakuru and Meru towns are Sh.98 and Sh.106 respectively.
2. The unit transportation costs (in shillings) from each milling plant to each distribution office are given as follows:

		To			
		Mombasa	Kisumu	Nairobi	Isiolo
	Eldoret	64	36	52	58
From	Nanyuki	56	52	44	32
	Narok	58	42	36	50

3. The estimated unit transportation costs (in shillings) from each of the proposed milling plants to each distribution office are as follows:

		To			
		Mombasa	Kisumu	Nairobi	Isiolo
From	Nakuru	60	46	40	52
	Meru	62	56	46	28

4. Assume that the construction of one of the proposed milling plants would satisfy the demand deficiency.

Required:
Using the Vogel's approximation method (VAM), advise the management of Farm Produce Limited on the best location to construct the milling plant. (12 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Outline three differences between the normal distribution and the t-distribution. (3 marks)

(b) A certain project is expected to be completed within 18 weeks. The expected net revenue if the project is completed on time is Sh.1,120,000 but a penalty of Sh.484,000 will be imposed if the project is not completed on time. The cost of the project is Sh.459,000. The standard deviation of the project's duration is 2.08 weeks.

The table below is a summary of activities required to complete the project, the duration of the activities and their preceding activities.

Activity	Duration (weeks)	Preceding activity
A	5	-
B	2	-
C	4	-
D	2	B
E	5	B,C
F	7	C
G	6	A,D
H	3	G, D, E, F

Required:

(i) A network diagram of the project. (8 marks)

(ii) The float times of activities B and D. (2 marks)

(iii) The critical path of the project. (1 mark)

(iv) A 95 per cent confidence interval of the expected completion time of the project. (2 marks)

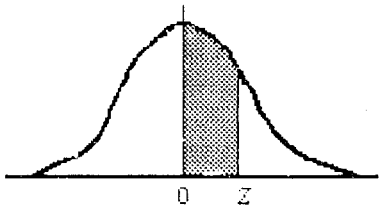
(v) The expected profit from the project. (4 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

t-table.xls 7/14/2007

KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

FRIDAY: 27 November 2015. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Star Manufacturers Limited specialises in the production of two products, A and B. The manufacturer sells the products at a fixed selling price to its customers. The following table shows the requirements for production of products A and B:

	Product		
	A	**B**	**Available resources**
Materials (Kilogrammes)	5	7	13,400
Labour (Hours)	3	4	7,800

Product A is sold for Sh.2,080 per unit whereas product B is sold for Sh.7,939 per unit. The variable costs of production are uncertain with the following margins of error:

	Product		
	A	**B**	**Error**
Labour/Hour (Sh.)	140	265	± 10%
Material/Kilogramme (Sh.)	236	710	± 5%

Star Manufacturers Limited utilises all the available resources.

Required:
Using matrix algebra, determine:

(i) The total expected revenue. (3 marks)

(ii) The expected maximum profit. (3 marks)

(iii) The expected minimum profit. (3 marks)

(b) Apex Limited is planning to launch a new product in the market. It has undertaken a survey on the product's colour, brand name and packaging. The company sent questionnaires to 200 potential customers to obtain their views on the three attributes of the product. The results were as follows:

- 24 persons liked the packaging and the brand name.
- 77 persons liked the brand name or the colour but did not like the packaging.
- 40 persons liked the colour only.
- 120 persons liked the colour or the brand name.
- 23 persons liked the colour and the packaging.
- 43 persons liked at least two of the three attributes.
- 5 persons did not like any of the three attributes.
- The questionnaires of 25 persons were not received back.

The company's policy is to incorporate an attribute in the product if at least 50 per cent of the respondents liked the attribute.

Required:

(i) Present the above information in a venn diagram. (6 marks)

(ii) Number of persons that liked all the three attributes. (1 mark)

(iii) Proportion of persons that liked the colour. (1 mark)

(iv) Proportion of persons that liked the brand name. (1 mark)

(v) Proportion of persons that liked the packaging. (1 mark)

(vi) Attribute(s) to be incorporated in the product. (1 mark)

(Total: 20 marks)

QUESTION TWO

(a) Explain how differential calculus could be used in solving optimisation problems. (2 marks)

(b) The marginal cost and demand functions for Ujenzi Limited are given as follows:

$MC = 2x + 16$ (in Sh.million)
and
$P = x^2 - 24x + 117$ (in Sh.million)

Where:
MC is the marginal cost function
P is the price of a building constructed
x is the number of buildings constructed in a year.

The total annual fixed costs of the company amount to Sh.39 million.

Required:

(i) The profit function. (2 marks)

(ii) The selling price per building constructed that will maximise profit. (3 marks)

(c) The data below show the number of cars imported by a certain car dealer over a four-year period:

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2011	20	32	62	29
2012	21	42	75	31
2013	23	39	77	48
2014	27	39	92	53

Required:

(i) The trend equation, using the least squares method. (5 marks)

(ii) Average seasonal index for each quarter using the multiplicative model. (4 marks)

(iii) Year 2015 seasonally adjusted import forecasts for each quarter. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Outline four applications of the programme evaluation and review technique (PERT) in the planning and management of projects. (4 marks)

(b) The table below relates to the number of units packaged by nine casual employees of Bidii Limited and the packaging time taken by each of the employees:

Number of units packaged	14	8	9	12	6	11	10	5	10
Time (seconds)	230	110	130	190	109	181	154	79	144

Required:

(i) The regression line of packaging time against the number of units packaged. (6 marks)

(ii) The product moment correlation coefficient. (3 marks)

(iii) The standard error of estimate. (3 marks)

(iv) A 95 per cent interval estimate of the regression line. (2 marks)

(v) The packaging time interval for 7 units. (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Explain the following terms as used in game theory:

(i) Pure strategy. (1 mark)

(ii) Saddle point. (1 mark)

(b) Highlight four applications of linear programming in business. (4 marks)

(c) Quick Works Limited deals in the provision of typing services. On average, a typist at the company receives 22 letters per day for typing. The typist works for 8 hours a day and it takes an average of 20 minutes to type a letter. The company has determined that the cost of a letter waiting to be typed is Sh.8 per hour and the typing equipment operating cost plus the salary of the typist amount to Sh.400 per day. In an attempt to improve on the letter typing service, the company is planning to lease one of the two models of automated typewriters to be used together with the existing typing equipment. The additional cost per day and the increase in typist's efficiency of the two models is as given below:

Model	**Additional cost per day (Sh.)**	**Increase in typist's efficiency (%)**
I	370	50
II	390	75

Required:

Advise the company on the action that it should take in order to minimise the total daily cost. (5 marks)

(d) Jane Cherop was employed by Golden Houses Limited as a sales agent last year. During the year, she was able to sell up to a maximum of 6 houses in a month. Due to good performance in the past year, the company has offered Jane Cherop one of the following three salary plans for the next year:

Plan A: A 25 per cent salary increament to Sh.50,000 per month.

Plan B: A fixed monthly salary of Sh.20,000 per month plus a commission of Sh.12,000 per house sold.

Plan C: No monthly salary but a commission of Sh.20,000 per house sold.

Required:

(i) The optimal salary plan for Jane Cherop based on the maximin criterion. (3 marks)

(ii) The optimal salary plan for Jane Cherop based on the minimax regret criterion. (3 marks)

(iii) Assume that during the past year, the distribution of the houses sold by Jane Cherop for the twelve months was as follows:

Number of houses sold	0	1	2	3	4	5	6
Number of months	1	2	1	2	1	3	2

Advise Jane Cherop on the optimal salary plan based on the expected value criterion. (3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) A simulation model attempts to describe a business system using a number of equations. These equations are characterised by four types of variables.

Required:
With reference to the above statement, explain the four types of variables in a simulation equation. (8 marks)

(b) The table below shows the probability distribution of the number of digital boxes sold by an electronics store on a daily basis:

Digital boxes sold (units)	0	1	2	3	4	5	6	7	8
Probability	0.05	0.05	0.10	0.15	0.20	0.15	0.15	0.10	0.05

Required:

(i) The probability that the number of digital boxes sold in a given day is at least 3 but less than 7. (2 marks)

(ii) The mean daily sales of digital boxes. (2 marks)

(iii) The standard deviation of digital boxes daily sales. (2 marks)

(c) The sales manager of Uza Limited has obtained the following data on the values of a random sample of 100 outstanding sales invoices of the company:

Value Sh."000"	**Number of outstanding sales invoices**
0 < 100	20
100 < 200	18
200 < 300	22
300 < 400	15
400 < 500	9
500 < 600	8
600 < 700	4
700 < 800	2
800 < 900	2
	100

Required:

(i) The standard deviation of the random sample. (4 marks)

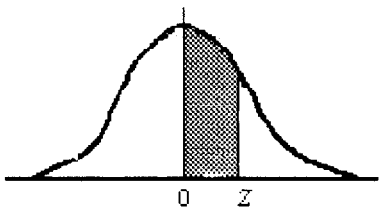
(ii) A 95 per cent confidence level of the mean value of outstanding sales invoices. (2 marks)

(Total: 20 marks)

.....

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

PILOT PAPER

September 2015. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Highlight any four assumptions of Markov Analysis. (4 marks)

(b) The research industry in your country has three market research firms namely X, Y and Z which provide research services. The following data has been collected in relation to the flow of clients among the three firms:

	Number of clients	Market share	Flow of Clients						Number of clients	Market share
			Gains from			Losses to				
	31.12.2013		X	Y	Z	X	Y	Z	31.12.2014	
X	408	0.177	-	24	40	-	30	18	424	0.184
Y	832	0.361	30	-	10	24	-	14	834	0.362
Z	1062	0.461	18	14	-	40	10	-	1044	0.454

Required:

(i) Convert the above data into a matrix of transition probabilities. (4 marks)

(ii) Estimate each firm's market share for 2015. (4 marks)

(c) A firm has a linear demand function for its product. When the price of the product is Sh. 220, the quantity demanded is 40 units. When the price increases to Sh. 240 the quantity demanded becomes 30 units. In addition, the firm's marginal cost function is given by:

$MC = 40q - 2q^2 + 2$
Fixed cost = Sh. 5million

where q = quantity demanded, MC = marginal cost (in Sh. million)

Required:

(i) The level of output that maximises profits. (3 marks)

(ii) The maximum profit. (1mark)

(iii) The price of the product at the maximum profit. (1mark)

(iv) The price elasticity of demand when the profit is at the maximum (interpret your result). (3 marks)

(Total: 20 marks)

QUESTION TWO

(a) The City Theatre has four auditoriums namely C1, C2, C3 and C4. Each auditorium performs a different play at any given time. The performances start at different times to avoid long queues that would occur if all the auditoriums were to start performance at the same time. The theatre has a single ticket booth and a cashier who can maintain an average service rate of 280 patrons per hour. Arrivals are poisson distributed at an average of 210 patrons per hour. The services are assumed to follow an exponential distribution.

Required:

(i) The average number of patrons waiting in line to purchase the tickets. (2 marks)

(ii) The average time spent waiting in line to get to the ticket window. (2 marks)

(iii) The average time a patron spends in the system. (2 marks)

(iv) The percentage of time the cashier is busy. (2 marks)

(v) The probability that there are more than two people in the system. (2 marks)

(b) A marketing firm employs part-time marketers. The hours worked and the earnings of ten such marketers are as shown below:

Marketer	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Hours worked (x)	20	30	48	39	28	14	60	50	62	43
Earnings (Sh. "000") (y)	5.5	7.4	11.0	9.3	7.2	4.3	13.5	12.0	14.0	10.0

Required:

(i) The least squares regression function relating the hours worked and earnings. Interpret your results. (6 marks)

(ii) The Spearman's rank correlation coefficient. Comment on your result. (4 marks)

(Total: 20 marks)

QUESTION THREE

(a) Lanex Company specialises in the production of an industrial dye. The firm manufacturers two types of dyes; light and dark. The selling price and the unit variable costs for the dyes are shown below:

Production	**Selling price (Sh.) per litre**	**Unit variable cost (Sh.) per litre**
Light	13.00	9.00
Dark	16.00	10.00

Each litre of light dye requires 6 minutes of skilled labour and each litre of dark dye requires 12 minutes of skilled labour.

In a given day, there are 400 man hours of skilled labour available. There are also 100 grammes of an important blending chemical available each day, where each litre of light dye requires 0.05 grammes of the blending chemical and each litre of dark dye requires 0.02 grammes of the chemical.

The processing capacity at the plant is limited to 3,000 litres of dye per day.

The company is committed to supply a leading retailer with 5,000 litres of light dye and 2,500 litres of dark dye each working week (consisting of five days). In addition, there is an agreement with the unions that at least 2,000 litres should be produced each day.

Lanex company's management would like to determine the daily production volume for each of the two dyes that will maximise total contribution.

Required:

(i) A linear programming model of the production problem facing Lanex company. (2 marks)

(ii) Using the graphical approach, determine the optimum daily production plan and consequent contribution. (8 marks)

(b) Brightshine Limited based in Nairobi manufactures a detergent. The firm is considering opening a new plant in Nakuru. The opening of a new plant will, however, depend on the demand for the detergent in Nakuru.

Information concerning the demand for the detergent is shown below:

H - High demand and leads to a profit of Sh.6,000,000 per year.
M - Moderate demand and leads to a profit of Sh.1,500,000 per year.
L - Low demand and leads to a loss of Sh.2,500,000 per year.

The chances of having high, moderate and low demand are assessed at 30%, 30% and 40% respectively by the firm's management.

A market research group could be employed to provide information on which market demand would be realised. Past experience with work in the same market with this group shows its information cannot be relied upon to be absolutely accurate.

The market research group classifies its results as either being good prospects (G) or poor prospects (P). The table below gives the extent of reliability of this market research group:

Market survey	**Actual state of nature**		
Result	**H**	**M**	**L**
G	0.7	0.6	0.2
P	0.3	0.4	0.8

The market research group would charge a fee of Sh.60,000 if it was hired.

Required:

(i) The best course of action on the basis of prior information. (2 marks)

(ii) The expected value of perfect information. (2 marks)

(iii) Advise Brightshine Limited whether the market research should be conducted. Show your workings using a decision tree. (6 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Distinguish between the following sets of terms:

(i) Zero-sum game and non-zero sum game. (2 marks)

(ii) Pure strategy game and Mixed strategy game. (2 marks)

(b) An engineering firm is tendering for a contract to supply a steel fabrication. The tasks have been analysed as follows:

Activity	**Predecessor activity**	**Time (Days)**
A	-	10
B	-	12
C	A	10
D	A	9
E	A	13
F	A, B	17
G	C	12
H	C, D	14
I	E	13
J	G, H	12
K	H	10
L	H, I	14
M	H, I, F	13

Required:

(i) A network diagram for the project. (8 marks)

(ii) The critical path and the expected project duration. (4 marks)

(iii) The time schedules for activities F, G and H. (4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) A machine is composed of three components X, Y and Z. The probability that component X is in good working condition is $^{7}/_{10}$. If component X is in good working condition, the probability that component Y is in good working condition is $^{3}/_{5}$. If component X is not in good working condition, the probability that component Y is in good working condition is $^{1}/_{3}$. If components X and Y are in good working condition, the probability that component C is in good working condition is $^{5}/_{6}$, otherwise, it is $^{1}/_{10}$.

The machine can only be effective when component Z is in good working condition.

Required:

(i) The probability that the machine is effective. (2 marks)

(ii) The probability that only one component Y or Z is in good working condition. (2 marks)

(iii) The probability that component Y is in good working condition given that component Z is in good working condition. (2 marks)

(b) The data below represent the sales made by Pengo Traders for a period of three years:

	Sales (Sh. "000,000") Quarter			
Year	**1**	**2**	**3**	**4**
2012	2.2	5	7.9	3.2
2013	2.9	5.2	8.2	3.8
2014	3.2	5.8	9.1	4.1

Required:

(i) The centred moving average trend values. (4 marks)

(ii) The seasonal additive indices. (4 marks)

(iii) The deseasonalised time series. (2 marks)

(c) Highlight the four components of a time series. (4 marks)

(Total: 20 marks)

.....