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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 $T = \begin{bmatrix} 2 & 4 \\ 2 & 0 \end{bmatrix}$ and

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

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		**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)

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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											
7											
8											
9											
10											
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											
17											
18											
19											
20											
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											
27											
28											
29											
30											
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
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
						Confidence Level					