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:

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

(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:

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

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

NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z
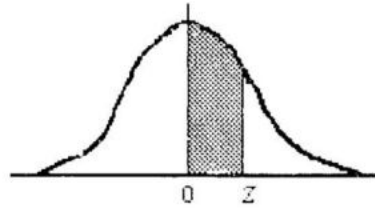
z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.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