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.

(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)

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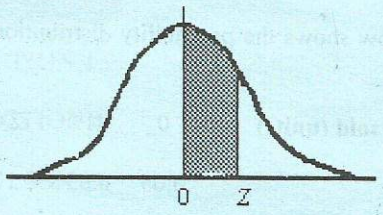
NORMAL CURVE

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	.444
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.453[illegible]	
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616		
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693		
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756		.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	[illegible]
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	[illegible]
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	[illegible]	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	[illegible]	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										