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)

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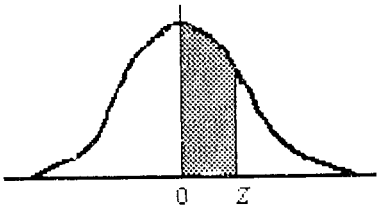
NORMAL CURVE

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	.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										