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**QUANTITATIVE TECHNIQUES**

November 2022

Time: 3 hours



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

**DIPLOMA IN SUPPLY CHAIN MANAGEMENT  
DIPLOMA IN BUSINESS MANAGEMENT  
DIPLOMA IN INFORMATION SCIENCE  
DIPLOMA IN ENTREPRENEURSHIP  
DIPLOMA IN HUMAN RESOURCE MANAGEMENT**

**QUANTITATIVE TECHNIQUES**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*This paper consists of SEVEN questions.*

*Answer any FIVE questions in the answer booklet provided.*

*All questions carry equal marks.*

*Candidates should answer the questions in English.*

**This paper consists of 7 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

- ✓1. (a) Explain five uses of index numbers in decision making. (8 marks)
- (b) The following information relates to a project to be undertaken by a company:

Activity	Preceding Activities	Time duration (weeks)
A	—	7
B	—	10
C	B	15
D	A	17
E	A	14
F	C, E	9
G	B	15
H	D	7
I	F, H, J	11
J	G	12
K	G	7
L	I, K	9

- (i) Draw a network diagram of the project.
- (ii) Determine the:
- I. critical path;
  - II. project duration.
- (12 marks)

- ✓2. (a) Explain the meaning of each of the following types of matrices, giving an example in each case:
- (i) equal matrices;
  - (ii) row matrix;
  - (iii) transpose matrix;
  - (iv) scalar matrix;
  - (v) square matrix.
- (10 marks)

- (b) The following information shows the number of years of experience and the corresponding number of units produced by employees of a company in a certain month.

**Number of years of experience      Units produced**

16	54
22	56
7	59
30	44
44	49
53	30
10	54
26	44

- (i) Calculate Pearson's coefficient of correlation.  
 (ii) Interpret the results in (i) above.

(10 marks)

3. (a) Outline **five** limitations of quantitative techniques in business decision making.

(10 marks)

- (b) A factory uses 3 machines; J, K and L to make pens. Machine J makes 35% of the pens, machine K makes 40% of the pens and the rest are made by machine L. It is known that 5% of the pens made using machine J are faulty, 3% of the pens made using machine K are faulty and 2% of the pens made using machine L are faulty. A pen is selected at random.

Calculate the possibility that:

- (i) the pen is made using machine J and is not faulty;  
 (ii) the pen is faulty and is made using either by machine K or machine L;  
 (iii) the pen is made using machine L and is faulty.

(10 marks)

4. (a) Highlight **five** rules followed when drawing network diagrams.

(10 marks)

- (b) The following is the average revenue (AR) function and total cost (TC) function of a firm:

$$AR = 3000 - 0.05q$$

$$TC = 5,000 + 6q = q^2$$

Where  $q$  is the level of output produced and sold. Determine the:

- (i) total revenue function;  
 (ii) level of output that maximises profit;  
 (iii) profit function;  
 (iv) price that maximise profit;  
 (v) maximum profit.

(10 marks)

- ✓ 5. (a) A company uses component TQ in its production process. The following information relates to the company's inventory policy:

	Minimum	Normal	Maximum
Lead time (in days)	4	8	12
Demand in units (per day)	80	110	140

The company's Economic Order Quantity (EOQ) and safety stock level are 300 units and 160 units respectively.

- (i) Calculate the:

- I. re-order level;
- II. minimum stock level;
- III. maximum stock level.

- (ii) Outline **two** factors that determine the re-order level. (8 marks)

- (b) Mary has received Ksh 2,400,000 in form of retirement benefits. She intends to invest the money in one of the following options:

**Option 1:** Invest in a mutual fund that pays 10% compound interest per year compounded half yearly for 3 years.

**Option 2:** Invest in a company that pays 15% simple interest per annum for 3 years.

**Option 3:** Invest Ksh 800,000 at the beginning of each year for 3 years in an account paying 10% compound interest per annum.

- (i) Calculate the amount accumulated under each investment option over the 3 year period.

- (ii) Based on the results in (i) above, advise Mary on the option to invest in. (12 marks)

6. (a) The sales manager of a company claims that their daily sales have increased after conducting an inhouse sales training. Before the training the daily sales were Ksh 60,000. A sample of 16 sales person's form the company was selected at random after the training and the average sales were found to be Ksh 95,000 with a standard deviation of Ksh 1,100. Test the manager's claim at 5% significance level.

(8 marks)

- (b) The following data shows the production in tonnes of a product manufactured by a company over a period of eight years.

Year	Units produced (tonnes)
2012	21
2013	20
2014	22
2015	29
2016	27
2017	18
2018	12
2019	22

- (i) Using the least squares method, determine the linear regression equation of the data above.
- (ii) Using the equation in (i) above, estimate the production for the year 2022. (12 marks)

7. (a) An ICT examination was conducted for 200 students in a college. The marks scored were found to be normally distributed with a mean of 66 marks and a standard deviation of 5 marks. Calculate the number of students whose marks were:

- (i) above 68 marks;
- (ii) between 56 marks and 70 marks;
- (iii) below 72 marks. (10 marks)

- (b) A company uses two types of components; S and T to manufacture a product. The per unit costs of the components S and T are Ksh 3,500 and Ksh 4,500 respectively. A unit of a product requires 4 units of component S and 8 units of component T. The company intends to purchase at least a total of 13 components. The current market demand for the product is at least 64 units.

- (i) Formulate a linear programming problem from the information above.
- (ii) Using the graphical approach, determine the number of components of each type that should be purchased in order to minimize total costs. (10 marks)

### Critical Values of the t - Distribution

df ( v )	Level of significance for two-tailed test						
	0.2	0.1	0.05	0.02	0.01	0.005	0.001
	20%	10%	5%	2%	1%	0.5%	0.1%
1	3.077684	6.313752	12.706205	31.820516	63.656741	127.321336	636.619249
2	1.885618	2.919986	4.302653	6.964557	9.924843	14.089047	31.599055
3	1.637744	2.353363	3.182446	4.540703	5.840909	7.453319	12.923979
4	1.533206	2.131847	2.776445	3.746947	4.604095	5.597568	8.610302
5	1.475884	2.015048	2.570582	3.364930	4.032143	4.773341	6.868827
6	1.439756	1.943180	2.446912	3.142668	3.707428	4.316827	5.958816
7	1.414924	1.894579	2.364624	2.997952	3.499483	4.029337	5.407883
8	1.396815	1.859548	2.306004	2.896459	3.355387	3.832519	5.041305
9	1.383029	1.833113	2.262157	2.821438	3.249836	3.689662	4.780913
10	1.372184	1.812461	2.228139	2.763769	3.169273	3.581406	4.586894
11	1.363430	1.795885	2.200985	2.718079	3.105807	3.496614	4.435979
12	1.356217	1.782288	2.178813	2.680998	3.054540	3.428444	4.317791
13	1.350171	1.770933	2.160369	2.650309	3.012276	3.372468	4.220832
14	1.345030	1.761310	2.144787	2.624494	2.976843	3.325696	4.140454
15	1.340606	1.753050	2.131450	2.602480	2.946713	3.286039	4.072766
16	1.336757	1.745884	2.119905	2.583487	2.920782	3.251993	4.014996
17	1.333379	1.739607	2.109816	2.566934	2.898231	3.222450	3.965126
18	1.330391	1.734064	2.100922	2.552380	2.878440	3.196574	3.921646
19	1.327728	1.729133	2.093024	2.539483	2.860935	3.173725	3.883406
20	1.325341	1.724718	2.085963	2.527977	2.845340	3.153401	3.849516
21	1.323188	1.720743	2.079614	2.517648	2.831360	3.135206	3.819277
22	1.321237	1.717144	2.073873	2.508325	2.818756	3.118824	3.792131
23	1.319460	1.713872	2.068658	2.499867	2.807336	3.103997	3.767627
24	1.317836	1.710882	2.063899	2.492159	2.796939	3.090514	3.745399
25	1.316345	1.708141	2.059539	2.485107	2.787436	3.078199	3.725144
26	1.314972	1.705618	2.055529	2.478630	2.778715	3.066909	3.706612
27	1.313703	1.703288	2.051830	2.472660	2.770683	3.056520	3.689592
28	1.312527	1.701131	2.048407	2.467140	2.763262	3.046929	3.673906
29	1.311434	1.699127	2.045230	2.462021	2.756386	3.038047	3.659405
30	1.310415	1.697261	2.042272	2.457262	2.749996	3.029798	3.645959
31	1.309464	1.695519	2.039513	2.452824	2.744042	3.022118	3.633456
32	1.308573	1.693889	2.036933	2.448678	2.738481	3.014949	3.621802
33	1.307737	1.692360	2.034515	2.444794	2.733277	3.008242	3.610913
34	1.306952	1.690924	2.032244	2.441150	2.728394	3.001954	3.600716
35	1.306212	1.689572	2.030108	2.437723	2.723806	2.996047	3.591147
40	1.303077	1.683851	2.021075	2.423257	2.704459	2.971171	3.550966
45	1.300649	1.679427	2.014103	2.412116	2.689585	2.952079	3.520251
50	1.298714	1.675905	2.008559	2.403272	2.677793	2.936964	3.496013
60	1.295821	1.670649	2.000298	2.390119	2.660283	2.914553	3.460200
70	1.293763	1.666914	1.994437	2.380807	2.647905	2.898734	3.435015
80	1.292224	1.664125	1.990063	2.373868	2.638691	2.886972	3.416337
90	1.291029	1.661961	1.986674	2.368497	2.631565	2.877884	3.401935
100	1.290075	1.660234	1.983971	2.364217	2.625891	2.870652	3.390491
120	1.288646	1.657651	1.979930	2.357825	2.617421	2.859865	3.373454
df ( v )	10%	5%	2.5%	1%	0.5%	0.25%	0.05%
	0.1	0.05	0.025	0.01	0.005	0.0025	0.0005
Level of significance for one-tailed test							

Table A Present Value of Sh 1 Received at the End of n Periods:

$$PVIF_{r,n} = 1/(1+r)^n$$

Period %	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	.9801	.9708	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.8929	.8772	.8696	.8621	.8475	.8333	.8055	.7813	.7576	.7353
2	.9603	.9426	.9248	.9070	.8890	.8734	.8573	.8417	.8264	.7972	.7695	.7561	.7432	.7182	.6944	.6504	.6104	.5729	.5407
3	.9406	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4788	.4348	.3975
4	.9210	.8938	.8665	.8402	.8149	.7921	.7699	.7484	.7274	.6780	.6355	.6181	.6013	.5643	.5323	.4730	.4230	.3725	.3294
5	.9015	.8726	.8435	.8143	.7851	.7613	.7380	.7154	.6933	.6357	.5944	.5769	.5601	.5191	.4841	.4200	.3651	.3176	.2749
6	.8820	.8513	.8206	.7900	.7594	.7356	.7123	.6895	.6671	.6005	.5601	.5426	.5258	.4804	.4514	.3833	.3344	.2840	.2419
7	.8627	.8303	.7979	.7656	.7333	.7099	.6866	.6637	.6412	.5757	.5362	.5187	.5019	.4524	.4284	.3563	.3044	.2511	.2080
8	.8435	.8103	.7770	.7438	.7106	.6863	.6620	.6381	.6146	.5501	.5116	.4941	.4773	.4240	.4040	.3280	.2721	.2168	.1739
9	.8243	.7903	.7563	.7223	.6883	.6630	.6387	.6148	.5913	.5278	.4893	.4718	.4550	.4000	.3840	.3040	.2441	.1868	.1449
10	.8051	.7703	.7354	.7005	.6656	.6403	.6160	.5921	.5686	.5061	.4676	.4501	.4333	.3750	.3620	.2780	.2141	.1558	.1149
11	.7860	.7503	.7154	.6805	.6456	.6203	.5960	.5721	.5486	.4871	.4486	.4311	.4143	.3530	.3420	.2540	.1861	.1278	.0879
12	.7670	.7303	.6954	.6605	.6256	.6003	.5760	.5521	.5286	.4681	.4296	.4121	.3953	.3310	.3220	.2290	.1661	.1078	.0679
13	.7480	.7103	.6754	.6405	.6056	.5803	.5560	.5321	.5086	.4491	.4106	.3931	.3763	.3090	.3020	.2050	.1371	.0788	.0389
14	.7290	.6903	.6554	.6205	.5856	.5603	.5360	.5121	.4886	.4301	.3916	.3741	.3573	.2870	.2820	.1800	.1071	.0488	.0089
15	.7100	.6703	.6354	.6005	.5656	.5403	.5160	.4921	.4686	.4111	.3726	.3551	.3383	.2650	.2620	.1560	.0771	.0188	.0009
16	.6910	.6503	.6154	.5805	.5456	.5203	.4960	.4721	.4486	.3921	.3536	.3361	.3193	.2430	.2420	.1330	.0511	.0038	.0000
17	.6720	.6303	.5954	.5605	.5256	.5003	.4760	.4521	.4286	.3731	.3346	.3171	.3003	.2210	.2220	.1090	.0211	.0048	.0000
18	.6530	.6103	.5754	.5405	.5056	.4803	.4560	.4321	.4086	.3541	.3156	.2981	.2813	.2000	.2020	.0850	.0091	.0068	.0000
19	.6340	.5903	.5554	.5205	.4856	.4603	.4360	.4121	.3886	.3351	.2966	.2791	.2623	.1780	.1820	.0610	.0051	.0051	.0000
20	.6150	.5703	.5354	.5005	.4656	.4403	.4160	.3921	.3686	.3161	.2776	.2601	.2433	.1570	.1630	.0460	.0041	.0041	.0000
25	.5410	.5003	.4654	.4305	.3956	.3703	.3460	.3221	.2986	.2471	.2086	.1911	.1743	.0810	.0880	.0210	.0021	.0021	.0000
30	.4710	.4303	.3954	.3605	.3256	.3003	.2760	.2521	.2286	.1781	.1406	.1231	.1063	.0410	.0480	.0010	.0010	.0010	.0000
40	.3710	.3303	.2954	.2605	.2256	.2003	.1760	.1521	.1286	.0791	.0416	.0241	.0073	.0000	.0000	.0000	.0000	.0000	.0000
50	.2710	.2303	.1954	.1605	.1256	.1003	.0760	.0521	.0286	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
60	.1710	.1303	.0954	.0605	.0256	.0003	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

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