2209/301
QUANTITATIVE METHODS
Oct./Nov. 2018
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION TECHNOLOGY
MODULE III

QUANTITATIVE METHODS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Mathematical tables;
Non-programmable scientific calculator.
*This paper consists of **EIGHT** questions.*
Answer any FIVE questions in the answer booklet provided.
All questions carry equal marks.
Maximum marks for each part of a question are indicated.
Tables of present value factors and the standard normal distribution are attached.
Candidates should answer the questions in English.

This paper consists of 9 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) (i) Explain why unweighted aggregate price index is not preferred in construction of index numbers.

(ii) State **three** characteristics of mode as a measure of central tendency.

(5 marks)

(b) With the aid of frequency distribution curves, distinguish between positive skewness and negative skewness. (4 marks)

(c) Table 1 shows the consumption of electricity by 100 households during a particular week.

Table 1

Consumption (Kwh)	0 - 9	10 - 19	20-29	30 - 39	40 - 49	50 - 59	60 - 69	70 -79
Number of households	5	11	18	29	16	10	8	3

Determine the:

(i) mode;
(ii) interquartile range;
(iii) 69^{th} percentile;
(iv) 9^{th} decile.

(11 marks)

2. (a) Explain the following methods of fitting a trend of a time series:

(i) semi-averages method;
(ii) moving-averages method.

(6 marks)

(b) Table 2 shows the sales data (in millions of Kenya shillings) for Tinola Stationeries Ltd for the years 2012 to 2015 inclusive:

Table 2

Year	Quarter			
	1	2	3	4
2012	43	67	127	61
2013	45	87	153	65
2014	49	81	157	99
2015	57	81	187	109

Determine the:

(i) trend equation using the least squares method;

(ii) estimated sales for the second quarter of the year 2016.

(14 marks)

3. (a) Explain the following terms with reference to statistical inference:

(i) alternative hypothesis;
(ii) critical region;
(iii) interval estimate.

(6 marks)

(b) Table 3 shows the mileage recorded for a sample of company vehicles during a given week.

Table 3

164	138	150	132	144	125	149	157
158	146	140	147	136	148	152	144
168	126	138	176	163	129	154	165
146	173	142	147	135	153	140	135
161	145	135	142	150	156	145	128

(i) Group the data into classes 120 - 129, 130 - 139, ...

(ii) Using an assumed mean of 144.5, determine the mean and the standard deviation for the sample.

(iii) Construct the 95% confidence interval for the population mean mileage.

(14 marks)

4. (a) State **three** characteristics of a Binomial distribution. (3 marks)

(b) A quality inspector selects a sample of 10 flash-disks at random from a very large shipment of flash-disks known to contain 20% defectives.
Determine the probability of getting:

(i) exactly 3 defectives;

(ii) at most 2 defectives.

(7 marks)

(c) In a training scheme for young people, the time taken to attain a required standard of proficiency was measured.
Table 4, shows the recorded average training times in days for each age.

Table 4

Age (years) - (X)	16	17	18	19	20	21	22	23	24	25
Average training time (days) - (Y)	8	6	7	9	8	11	9	10	12	11

(i) Determine the product - moment correlation coefficient.

(ii) Comment on the results in b(i).

(10 marks)

5. (a) (i) List **three** types of stock-holding costs.

(ii) State **three** ways of controlling the stock-holding costs listed in a(i) above.

(6 marks)

(b) A sum of Ksh.100,000 was invested five years ago. At the end of each year, a further Ksh.10,000 was added. If an interest rate of 12% per annum was paid, determine the present value of the investment. (3 marks)

(c) A company has been awarded two contracts. The first contract pays an initial amount of Ksh.100,000 at the start of the contract and then Ksh.10,000 at the end of the four years of the contract. The second contract also lasts for four years and pays Ksh.45,000 at the end of each year. The company has enough resources to undertake only one of the contracts. Assuming a discount rate of 20 per cent, use the net present value to advise the company on which contract to choose. (11 marks)

6. (a) State **three** advantages of random sampling. (3 marks)

(b) Tati Electronics firm has developed a new product for the electronics industry. The company believes that an advertising campaign costing Ksh 190,000 would give the product a 70 per cent chance of success. It estimates that a product with this advertising support would provide a return of Ksh 1.2 million if successful and a return of Ksh 220,000 if not successful. Past experience suggests that without advertising support, a new product of this kind would have a 55 per cent chance of success giving a return of Ksh 1.1 million if successful and a return of Ksh 160,000 if not successful.

(i) Construct a decision tree.
(ii) Advise the company on its best course of action.

(9 marks)

(c) Given the population of a set of odd numbers {1, 3, 5, 7, 9},

(i) make a list of all possible samples of size 2 that can be drawn from the set; (Sample with replacement)

(ii) construct the sampling distribution of the sample means for samples of size 2 selected from the set;

(iii) show that the population mean is equal to the mean of the sampling distribution of the sample means;

(iv) determine the standard error of the mean.

(8 marks)

7. (a) Explain the following terms as used in project network analysis:

(i) dummy activity;
(ii) slack;
(iii) total float.

(6 marks)

(b) A company manufactures and sells three products A, B and C.
Sales data for the three products over the last four periods is shown in table 5.

Table 5

	Product A		Product B		Product C	
	Sales Volume (Units)	Sales Value (Ksh)	Sales Volume (Units)	Sales Value (Ksh)	Sales Volume (Units)	Sales Value (Ksh)
Period 1	202	15,352	513	61,584	104	16,848
Period 2	163	13,088	521	66,688	120	20,536
Period 3	151	12,382	573	76,209	159	27,930
Period 4	162	13,770	575	80,542	227	40,905

Determine the:

(i) Laspeyre's sales price index for period 4 based on period 1.

(ii) Paasche's sales quantity index for period 4 based on period 3.

(14 marks)

8. (a) The heights of students in a certain institution are normally distributed with a mean of 160 cm and a standard deviation of 10 cm. If a student is chosen at random, determine the probability that the student's height is:

(i) between 147 cm and 165 cm;

(ii) more than 175 cm.

(6 marks)

(b) Table 6 shows the weights of 40 students in a senior college.

Table 6

Weight (kg)	53 - 56	57 - 60	61 - 64	65 - 68	69 - 72	73 - 76	77 - 80
No. of Students	2	3	4	11	9	6	6

(i) Using an assumed mean of 66.5, determine the:

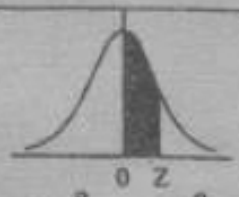
(I) mean;
(II) standard deviation.

(ii) Calculate the coefficient of variation.

(iii) Determine the median.

(14 marks)

Areas under the Standard Normal curve from 0 to Z



z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

PRESENT VALUE FACTORS

Years	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091
2	.9803	.9612	.9426	.9426	.9070	.8900	.8734	.8573	.8417	.8264
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209
6	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665
9	.9143	.8368	.7664	.7026	.6448	.5919	.5439	.5002	.4604	.4241
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855
11	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635
20	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486
21	.8114	.6598	.5375	.4388	.3589	.2942	.2415	.1987	.1637	.1351
22	.8034	.6468	.5219	.4220	.3418	.2775	.2257	.1839	.1502	.1228
23	.7954	.6342	.5067	.4057	.3256	.2618	.2109	.1703	.1378	.1117
24	.7876	.6217	.4919	.3901	.3101	.2470	.1971	.1577	.1264	.1015
25	.7798	.6095	.4776	.3751	.2953	.2830	.1842	.1460	.1160	.0923

Present value factors

(Continued)

Years	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	.9009	.8929	.8850	.8772	.8696	.8621	.8547	.8475	.8403	.8333
2	.8116	.7972	.7831	.7695	.7561	.7432	.7305	.7182	.7062	.6944
3	.7312	.7118	.6931	.6750	.6575	.6407	.6244	.6086	.5934	.5787
4	.6587	.6355	.6133	.5921	.5718	.5523	.5337	.5158	.4987	.4823
5	.5935	.5674	.5428	.5194	.4972	.4761	.4561	.4371	.4190	.4019
6	.5346	.5066	.4803	.4556	.4323	.4104	.3898	.3704	.3521	.3349
7	.4817	.4523	.4251	.3996	.3759	.3538	.3332	.3139	.2959	.2791
8	.4339	.4039	.3762	.3506	.3269	.3050	.2848	.2660	.2487	.2326
9	.3909	.3606	.3329	.3075	.2843	.2630	.2434	.2255	.2090	.1938
10	.3522	.3220	.2946	.2697	.2472	.2267	.2080	.1911	.1756	.1615
11	.3173	.2875	.2607	.2366	.2149	.1954	.1778	.1619	.1476	.1346
12	.2858	.2567	.2307	.2076	.1869	.1685	.1520	.1372	.1240	.1122
13	.2575	.2292	.2042	.1821	.1625	.1452	.1299	.1163	.1042	.0935
14	.2320	.2046	.1807	.1597	.1413	.1252	.1110	.0985	.0876	.0779
15	.2090	.1827	.1599	.1401	.1229	.1079	.0949	.0835	.0736	.0649
16	.1883	.163	.1415	.1229	.1069	.0930	.0811	.0708	.0618	.0541
17	.1696	.1456	.1252	.1078	.0929	.0802	.0693	.0600	.0520	.0451
18	.1528	.1300	.1108	.0946	.0808	.0691	.0592	.0508	.0437	.0376
19	.1377	.1161	.0981	.0826	.0703	.0596	.0506	.0431	.0367	.0313
20	.1240	.1037	.0868	.0728	.0611	.0514	.0433	.0365	.0308	.0261
21	.1117	.0926	.0768	.0638	.0531	.0443	.0370	.0309	.0259	.0217
22	.1007	.0826	.0680	.0560	.0462	.0382	.0316	.0262	.0218	.0181
23	.0907	.0738	.0601	.0491	.0402	.0329	.0270	.0222	.0183	.0151
24	.0817	.0659	.0532	.0431	.0349	.0284	.0231	.0188	.0154	.0126
25	.0736	.0588	.0471	.0378	.0304	.0245	.0197	.0160	.0129	.0105

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