Name:_____ Index No:_____

2902/204
2908/204
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2920/204

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Date:_____

QUANTITATIVE METHODS
November 2012
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN SALES AND MARKETING
DIPLOMA IN HUMAN RESOURCE MANAGEMENT
DIPLOMA IN ROAD TRANSPORT MANAGEMENT
DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE II

QUANTITATIVE METHODS

3 hours

INSTRUCTIONS TO CANDIDATES:

*Write your **name** and **index number** in the spaces provided above.*
*Sign and write the **date of examination** in the spaces provided above.*
*Answer any **FIVE** of the following **EIGHT** questions in the spaces provided on the question paper.*
All questions carry equal marks.
You should have the following for this examination:

Scientific calculator;
Statistical tables;
Geometrical set;

This paper consist of 13 printed pages

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

Turn over

1. (a) State **one** advantage and **two** disadvantages of presenting data in a distribution by grouping into classes. (3 marks)

(b) Table 1 shows the frequency distribution of the marks scored out of 100 by 250 students of Octopus University during the second semester of 2010 academic year. Use it to answer the questions that follow.

Marks	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99
No. of students	4	12	28	40	52	60	34	15	5

Table 1

(i) Determine the marks which enclose the central 50% of the students. (4 marks)

Median

(ii) Determine the proportion of students who would pass if the pass-mark is set at 45 marks. (4 marks)

(iii) The college requires the top 70% of the students to pass. Determine the pass-mark that should be set to achieve this. (3 marks)

(iv) A credit grade is awarded to marks in the range 55 to 75. Determine the number of students who would get a credit grade. (6 marks)

2. (a) Define the term *time series* as used in statistics. (2 marks)

(b) Using words and mathematical notations, explain the properties of the mean as applied in statistics. (8 marks)

(c) With the aid of a diagram in each case, illustrate the relative positions of the three measures of central tendency for each of the following types of distributions:

(i) symmetrical distribution;
(ii) negatively skewed distribution;
(ii) positively skewed distribution. (6 marks)

(d) Explain **two** limitations of the use of computers in statistical applications. (4 marks)

3. (a) State **four** advantages and **three** disadvantages of the median as a statistical measure. (7 marks)

(b) Given a finite population of 840 sampling units, select a random sample of size 20 using a systematic sampling technique. Assume a random start at 647th unit. (6 marks)

(c) The monthly salaries of employees of a commercial bank with branches in Kenya and South Africa were analysed. The salaries of employees in Kenya were found to have a mean of Ksh 70,000 and a standard deviation of Ksh 12,000, while the salaries of employees in South Africa were found to have a mean of 10,000 Rand and a standard deviation of 2,500 Rand.

(i) State whether the measures used are appropriate for comparing the dispersion. If not then recommend the most suitable measure. Justify your answer. (4 marks)

(ii) Identify the country which has a higher dispersion in income using the recommended measure in (i). (3 marks)

4. (a) Differentiate between *discrete data* and *continuous data* giving two examples in each case. (6 marks)

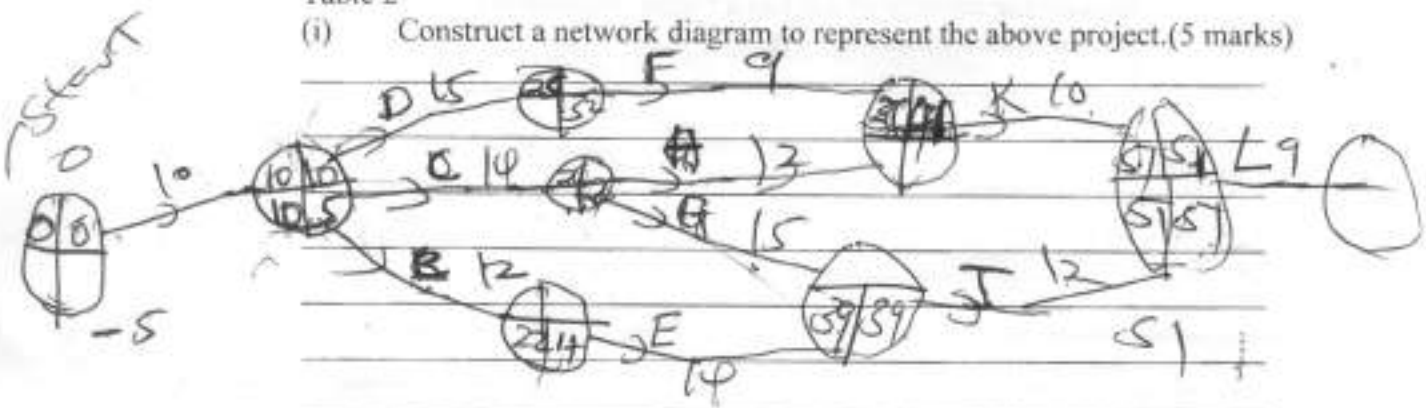
(b) Define the term *critical path* as used in project network analysis. (2 marks)

(c) The construction of a shopping mall has been broken down into various project activities with respective duration as shown in Table 2.

Activity	Preceding Activity	Duration in Weeks
A	--	10
B	A	12
C	A	14
D	A	15
E	B	14
F	D	9
G	C	15
H	C	12
J	E, G	12
K	F, H	10
L	J, K	9

Table 2

(i) Construct a network diagram to represent the above project. (5 marks)



51
34
15

6+4 m+p

6

(ii) Determine the critical path of the network and the expected project duration. (4 marks)

A C G J L

(iii) Compute the total floats for the non-critical activities. (3 marks)

60 days weeks

5. (a) "Causality implies correlation, but correlation does not imply causality". Justify this statement using **two** examples. (6 marks)

(b) The consumption of electric power in megawatt hours according to a power distribution company during a period of three consecutive years is as shown in Table 3.

Year	Power in megawatt hours			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2009	30	60	78	40
2010	37	64	85	44
2011	40	70	94	49

Table 3

(i) Determine the *least squares trend* for the consumption of electricity. (6 marks)

(ii) Using the *additive* model, determine the seasonal variation values for consumption of electricity. (4 marks)

(iii) Forecast the quarterly consumption of electricity for the year 2012. (4 marks)

6. (a) Distinguish between *primary data* and *secondary data* as used statistics. (4 marks)

(b) The Police Department collected data from a random sample of 10 PSV drivers on their driving experience in years and the corresponding number of traffic offences they committed in the year 2010. The data is as shown in Table 4.

Driver	A	B	C	D	E	F	G	H	J	K
Experience	5	2	8	12	6	9	10	14	6	8
Offences	10	18	15	6	16	8	10	4	16	3

Table 4

(i) Determine the Pearson's product moment co-efficient of correlation between the number of traffic offences and the length of experience of the PSV drivers. (8 marks)

x	y	xy	x^2	y^2
5	10	50	25	100
2	18	36	4	324
8	15	120	64	225
12	6	72	144	36
6	16	96	36	256
9	8	72	81	64
10	10	100	100	100
14	4	56	196	16
6	16	96	36	256
8	3	24	64	9
80	106	722	750	1386

(ii) Determine the co-efficient of determination between the number of traffic offences and the length of experience of the PSV drivers. (2 marks)

(iii) Draw conclusions from each of the measures computed in (i) and (ii) above. (6 marks)

i) There is a negative correlation between the two variables. (−0.74)

ii) There is a negative correlation which (−0.5)

- There are a fixed number of trials.

7. (a) State **three** characteristics of the binomial probability distribution. (3 marks)

- only two possible outcomes
- probability of success is the same for each
- There are n trials where n - trial is constant.
- the n trials are independent.

(b) From past experience it is known that only 15% of the chicks hatched are male. A random sample of 250 chicks hatched was taken. Assuming Poisson distribution, determine the probability that among this random sample:

(i) exactly 20 chicks are male; (2 marks)

(ii) at least 4 chicks are male; (4 marks)

(iii) between 3 and 5 chicks inclusive are male. (3 marks)

(c) Table 5 shows the price charged by an electrical shop for four categories of electric cables and their corresponding standard length in metres for the years 2007 and 2012.

Cable Type	2007		2012	
	Price per metre	Std length	Price per metre	Std length
Type X 1.5 mm	30	30	80	50
Type Y 1.5 mm	35	40	95	75
Type X 2.5 mm	50	30	120	30
Type Y 2.5 mm	54	40	140	75

Table 5

Calculate the following taking the year 2007 as the base:
(i) Laspeyre's price index;
(ii) Paasche's price index. (8 marks)

Laspeyres = $\frac{P_{190}}{P_{070}} \times 100$

Paasches = $\frac{P_{191}}{P_{091}} \times 100$

8. (a) Define the term *derivative* of a function as used in statistics. (2 marks)

(b) A private university analysed its past data and derived a profit function defined by the equation $p(x) = 21x - 2x^2 - 40$, where x represents the enrolment of students in thousands and the constant 40 represents fixed costs. Given that the profit and cost figures are in million Ksh, determine the following about the university:

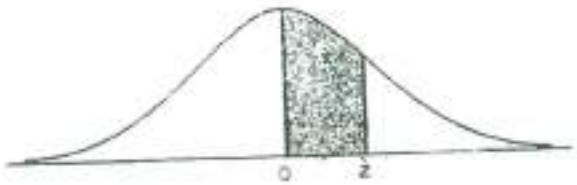
(i) Break-even point(s) for student enrolment; (4 marks)

(ii) Enrolment of students that maximises profit and the corresponding profit. (3 marks)

(iii) Suppose the university implements a new policy which is expected to reduce the fixed costs by 4 million Ksh, determine the new break-even point(s) for the student enrolment. (3 marks)

(c) State the application of each of the following in financial mathematics:
(i) arithmetic progression;
(ii) geometric progression. (2 marks)

(d) The Central Bank issued bonds worth 10 million shillings redeemable after 8 years. Determine how much they should invest in sinking fund earning interest at a rate of 12% p.a. in order to be able to redeem the bond. (6 marks)



Normal Probability

	Area under the standard normal curve from 0 to Z									
Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.000000	0.003989	0.007978	0.011966	0.015953	0.019939	0.023922	0.027903	0.031881	0.035856
0.1	0.039828	0.043795	0.047758	0.051717	0.055670	0.059618	0.063559	0.067495	0.071424	0.075345
0.2	0.079260	0.083166	0.087064	0.090954	0.094835	0.098706	0.102568	0.106420	0.110261	0.114092
0.3	0.117911	0.121720	0.125516	0.129300	0.133072	0.136831	0.140576	0.144309	0.148027	0.151732
0.4	0.155422	0.159097	0.162757	0.166402	0.170031	0.173645	0.177242	0.180822	0.184386	0.187933
0.5	0.191462	0.194974	0.198468	0.201944	0.205401	0.208840	0.212260	0.215661	0.219043	0.222405
0.6	0.225747	0.229069	0.232371	0.235653	0.238914	0.242154	0.245373	0.248571	0.251748	0.254903
0.7	0.258036	0.261148	0.264238	0.267305	0.270350	0.273373	0.276373	0.279350	0.282305	0.285236
0.8	0.288145	0.291030	0.293892	0.296731	0.299546	0.302337	0.305105	0.307850	0.310570	0.313267
0.9	0.315940	0.318589	0.321214	0.323814	0.326391	0.328944	0.331472	0.333977	0.336457	0.338913
1.0	0.341345	0.343752	0.346136	0.348495	0.350830	0.353141	0.355428	0.357690	0.359929	0.362143
1.1	0.364334	0.366500	0.368643	0.370762	0.372857	0.374928	0.376976	0.379000	0.381000	0.382977
1.2	0.384930	0.386861	0.388768	0.390651	0.392512	0.394350	0.396165	0.397958	0.399727	0.401475
1.3	0.403200	0.404902	0.406582	0.408241	0.409877	0.411492	0.413085	0.414657	0.416207	0.417736
1.4	0.419243	0.420730	0.422196	0.423641	0.425066	0.426471	0.427855	0.429219	0.430563	0.431888
1.5	0.433193	0.434478	0.435745	0.436992	0.438220	0.439429	0.440620	0.441792	0.442947	0.444083
1.6	0.445201	0.446301	0.447384	0.448449	0.449497	0.450529	0.451543	0.452540	0.453521	0.454486
1.7	0.455435	0.456367	0.457284	0.458185	0.459070	0.459941	0.460796	0.461636	0.462462	0.463273
1.8	0.464070	0.464852	0.465620	0.466375	0.467116	0.467843	0.468557	0.469258	0.469946	0.470621
1.9	0.471283	0.471933	0.472571	0.473197	0.473810	0.474412	0.475002	0.475581	0.476148	0.476705
2.0	0.477250	0.477784	0.478308	0.478822	0.479325	0.479818	0.480301	0.480774	0.481237	0.481691
2.1	0.482136	0.482571	0.482997	0.483414	0.483823	0.484222	0.484614	0.484997	0.485371	0.485738
2.2	0.486097	0.486447	0.486791	0.487126	0.487455	0.487776	0.488089	0.488396	0.488696	0.488989
2.3	0.489276	0.489556	0.489830	0.490097	0.490358	0.490613	0.490863	0.491106	0.491344	0.491576
2.4	0.491802	0.492024	0.492240	0.492451	0.492656	0.492857	0.493053	0.493244	0.493431	0.493613
2.5	0.493790	0.493963	0.494132	0.494297	0.494457	0.494614	0.494766	0.494915	0.495060	0.495201
2.6	0.495339	0.495473	0.495604	0.495731	0.495855	0.495975	0.496093	0.496207	0.496319	0.496427
2.7	0.496533	0.496636	0.496736	0.496833	0.496928	0.497020	0.497110	0.497197	0.497282	0.497365
2.8	0.497445	0.497523	0.497599	0.497673	0.497744	0.497814	0.497882	0.497948	0.498012	0.498074
2.9	0.498134	0.498193	0.498250	0.498305	0.498359	0.498411	0.498462	0.498511	0.498559	0.498605
3.0	0.498650	0.498694	0.498736	0.498777	0.498817	0.498856	0.498893	0.498930	0.498965	0.498999
3.1	0.499032	0.499065	0.499096	0.499126	0.499155	0.499184	0.499211	0.499238	0.499264	0.499289
3.2	0.499313	0.499336	0.499359	0.499381	0.499402	0.499423	0.499443	0.499462	0.499481	0.499499
3.3	0.499517	0.499534	0.499550	0.499566	0.499581	0.499596	0.499610	0.499624	0.499638	0.499651
3.4	0.499663	0.499675	0.499687	0.499698	0.499709	0.499720	0.499730	0.499740	0.499749	0.499758
3.5	0.499767	0.499776	0.499784	0.499792	0.499800	0.499807	0.499815	0.499822	0.499828	0.499835
3.6	0.499841	0.499847	0.499853	0.499858	0.499864	0.499869	0.499874	0.499879	0.499883	0.499888
3.7	0.499892	0.499896	0.499900	0.499904	0.499908	0.499912	0.499915	0.499918	0.499922	0.499925
3.8	0.499928	0.499931	0.499933	0.499936	0.499938	0.499941	0.499943	0.499946	0.499948	0.499950
3.9	0.499952	0.499954	0.499956	0.499958	0.499959	0.499961	0.499963	0.499964	0.499966	0.499967
4.0	0.499968	0.499970	0.499971	0.499972	0.499973	0.499974	0.499975	0.499976	0.499977	0.499978
4.1	0.499979	0.499980	0.499981	0.499982	0.499983	0.499983	0.499984	0.499985	0.499985	0.499986
4.2	0.499987	0.499987	0.499988	0.499988	0.499989	0.499989	0.499990	0.499990	0.499991	0.499991
4.3	0.499991	0.499992	0.499992	0.499993	0.499993	0.499993	0.499993	0.499994	0.499994	0.499994
4.4	0.499995	0.499995	0.499995	0.499995	0.499996	0.499996	0.499996	0.499996	0.499996	0.499996
4.5	0.499997	0.499997	0.499997	0.499997	0.499997	0.499997	0.499997	0.499998	0.499998	0.499998
4.6	0.499998	0.499998	0.499998	0.499998	0.499998	0.499998	0.499998	0.499998	0.499999	0.499999
4.7	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999
4.8	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999	0.499999
4.9	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000
5.0	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000	0.500000