1. (a) With the aid of diagrams, illustrate the following frequency distributions:

(i) positively skewed distribution;
(ii) negatively skewed distribution.

(4 marks)

(b) Distinguish between quantitative and qualitative data as used in statistics. (4 marks)

(c) In a certain donor funded institution, a cheque must be signed by four people; Chief Executive, Chairman, Finance officer and donor representative. The probabilities of the four signatories being available in a week are as follows: chief executive 0.94, chairman 0.70, finance officer 0.96, and donor representative 0.85. Cheques are drawn at random as need arises. The organisation wants to estimate the mean number of weeks when a cheque will fail to be fully signed by all the signatories in a period of 15 weeks.
Using the following random numbers, simulate the problem using Monte Carlo method.

CEO	90	70	96	26	10	13	50	11	04	42	07	58	33	97	32
Chairman	20	34	53	90	18	33	15	03	80	31	02	47	55	67	98
Finance officer	02	50	50	00	51	84	82	74	97	56	54	64	78	48	84
Representative	14	36	51	62	33	25	16	73	38	36	71	77	18	76	86

(12 marks)

2. (a) (i) Explain the term non-negativity condition as applied in linear programming.
(2 marks)

(ii) Explain the implication of the value of a slack variable greater than zero at optimum solution. (2 marks)

(b) Research has shown that the life span of Kenyans fit a normal distribution with a mean of 55 years and a standard deviation of 8 years.

(i) Determine the proportion of the population that will live up to the age of 48 years to 60 years. (6 marks)

(ii) The oldest 5% of the population are considered as the elders in the society. Determine the minimum age for a Kenyan to be viewed as an elder.
(4 marks)

(c) A businessman is confronted with choosing only one of the three investment options; A, B and C. If he chooses A and succeeds, then he makes a profit of Ksh 2000 but if he fails, then he loses Ksh 1250. If he chooses B and succeeds, then he makes a profit of Ksh 1800 but if he fails, then he loses Ksh 300. If he chooses C and succeeds, then he makes a profit of Ksh 3000 but if he fails, then he loses Ksh 1500.
The probability distribution for the investment options is as shown in Table 1.

Table 1

Investment options	A	B	C
Probability of success	0.55	0.40	0.25

(i) Using a pay-off table, compute the EMV for each option. (4 marks)

(ii) Using the result in (i), identify the best investment option for the businessman. (2 marks)

3. (a) Explain the term spurious correlation as used in statistics. (2 marks)

(b) Outline the steps involved in solving a linear programming problem using the Simplex method. (6 marks)

(c) Table 2 shows the expenditure incurred by Jupiter Communications Ltd on ICT projects for the last three successive years.

Table 2

Year	Expenditure in '000' Ksh			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2008	12	25	33	17
2009	15	31	40	23
2010	20	39	49	32

Assuming the additive model, forecast the above expenditure for the year 2011 using the least squares method. (12 marks)

4. (a) Distinguish between maximax and maximin as used in decision theory. (4 marks)

(b) Explain the term Monte Carlo Simulation as a method of statistical simulation. (2 marks)

(c) Table 3 shows the precedence table with multiple time estimates of activities involved in the plumbing of a residential flat. Use it to answer the questions that follow.

Table 3

Activity	Preceding Activity	Duration in weeks		
		Optimistic	Most Likely	Pessimis-tic
A	--	7	10	13
B	A	8	11	20
C	A	3	8	13
D	B	13	15	23
E	C	5	6	7
F	B	8	15	16
G	C	5	11	11
H	D, E	12	15	24
J	F	8	12	16
K	G	12	13	20
L	H, J, K	4	6	8

(i) Determine the expected duration for each activity in the project. (2 marks)

(ii) Construct a network diagram to represent the activities in the project. (4 marks)

(iii) Determine the critical path and the expected project duration. (4 marks)

(iv) Determine the probability of completing the project in 64 weeks. (4 marks)

5. (a) Explain **three** limitations of simulation in statistics. (6 marks)

(b) An educational researcher wanted to establish the nature and strength of the relationship between the performance of students in KCPE and KCSE. The mean mark was collected from a random sample of 10 students as shown in **Table 4**.

Table 4

Student		A	B	C	D	E	F	G	H	J	K
Mean Mark	KCPE	55	78	34	65	45	50	42	62	52	85
	KCSE	62	65	45	80	54	64	32	48	50	75

(i) Calculate the Pearson's product moment coefficient of correlation between the mean marks. (10 marks)

(ii) I. Calculate the co-efficient of determination between the mean marks. (4 marks)

6. (a) State **three** assumptions made in linear programming. (3 marks)

(b) Explain the importance of pre-testing during data collection in a large statistical survey. (3 marks)

(c) Table 5 shows the fare charged by a transport company for four types of vehicles and their corresponding number of passengers for the years 2005 and 2010.

Table 5

Type of Vehicle	2005		2010	
	Fare	No of Pass.	Fare	No of Pass.
Van	750	18	900	14
Mini bus	400	32	500	24
Executive bus	800	62	1000	51
Ordinary bus	650	65	800	62

Taking the year 2005 as the base, calculate the Laspeyre's price index. (6 marks)

(d) A sociology researcher wanted to estimate the proportion of women in Kenya satisfied with their marriages. A random sample of 400 married women in Kenya showed that 64% were satisfied. Determine the confidence limits for the population proportion of women satisfied with their marriages in Kenya at the 95% confidence level. (8 marks)

7. (a) Outline **three** ways of administering a questionnaire. (3 marks)

(b) Distinguish between primary data and secondary data as used statistics. (3 marks)

(c) A savings and credit cooperative is giving loans worth Ksh 5,000,000 to members repayable in a period of 10 years. In order to secure the loan, one must have a collateral. One member has a car which depreciates at a reducing balance rate of 9.5% p.a, while another has a piece of land which appreciates at a compound interest rate of 5.5% p.a. Determine the current minimum value of each item to enable each of the two members qualify for this loan. (8 marks)

(d) A mineral water processing plant packages water in bottles labelled as 1500 litres. The Kenya Bureau of Standards took a random sample of 256 bottles from the production line and found them to have a mean capacity of 1497 litres and a standard deviation of 24 litres. The bottles must have the correct capacity because less capacity implies exploitation of the consumer while excess capacity antagonises the factory's objective to maximise profit. Test whether this label of 1500 litres on the bottles is true at the 5% level of significance. (6 marks)

8. (a) Explain **three** reasons which would make a researcher prefer a sample survey to a census as a data collection technique. (6 marks)

(b) Distinguish between discounting rate and discounting factor as used in financial calculations. (4 marks)

(c) Table 7 shows the relative frequency distribution of the number of absent students in a class during the term. Use it to answer the question that follows.

Table 7

No. of absent students	0	1	2	3	4	5	6	7
Relative frequency	0.04	0.08	0.20	0.36	0.18	0.08	0.04	0.02

Determine the following measures:

(i) arithmetic mean;
(ii) median;
(iii) mode;
(iv) standard deviation.

(10 marks)