

1. (a) Table 1 shows profit in million Kenya shillings obtained from different branches in various bank accounts of a certain commercial bank during the year 2011. Use it to answer the question that follows.

**Table 1**

	Savings	Current	Fixed	Junior
Mombasa	25	30	35	15
Kisumu	18	22	30	10
Nakuru	20	26	22	12

Represent the data using the following graphs:

- (i) simple bar chart;  
(ii) percentage component bar chart. (6 marks)
- (b) A businessman invested Ksh 10 million at an interest rate of 12% p.a. compounded quarterly. Determine:  
(i) the actual percentage rate (APR) of interest;  
(ii) the amount accrued after 6 years. (6 marks)
- (c) A shopkeeper sells sugar in packets labelled 1000 grams. A random sample of 25 similar packets was taken and found to have a mean weight of 996 grams and a standard deviation of 8.5 grams. Test whether this shopkeeper exploits customers by selling underweight sugar at the following levels of significance:  
(i) 5% level;  
(ii) 1% level. (8 marks)
2. (a) Define the following statistical measures:  
(i) standard deviation;  
(ii) co-efficient of determination. (4 marks)
- (b) Differentiate between slack and surplus variables as used in linear programming. (4 marks)

- (c) The frequency distribution of age for 250 patients who attended a clinic in a district hospital on a particular day is as shown in Table 2.

**Table 2**

Age in years	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-99
No. of Patients	10	15	25	40	50	45	35	20	8

Determine the:

- (i) median age; (2 marks)
- (ii) standard deviation of the ages; (5 marks)
- (iii) proportion of patients whose age lies between 25 and 45 years. (5 marks)
3. (a) State **three** characteristics of a normal distribution curve. (3 marks)
- (b) Table 3 shows details of retail prices and standard quantities (weights) of four commodities; fuel, maize, sugar and cooking fat over a three year period (2008 and 2011).

**Table 3**

Commodity	Standard Quantity	Price in Ksh	
		2008	2011
	W	P <sub>0</sub>	P <sub>n</sub>
Fuel	10	85	115
Maize	15	60	150
Sugar	8	100	140
Cooking fat	6	90	150

Calculate the:

- (i) weighted average of price relatives;
- (ii) weighted aggregate of price index. (8 marks)

- (c) It is generally known that 60% of match boxes from a manufacturing process in a certain factory have exactly 40 match sticks. Based on this, determine the probability that among 12 randomly selected match boxes from the factory:
- exactly 4 boxes will have 40 match sticks;
  - between 2 and 4 boxes inclusive will have 40 match sticks;
  - at least 4 boxes will have 40 match sticks.

(9 marks)

4. (a) Define each of the following terms as used in time series analysis:

- trend;
- seasonal variation;
- random variation;
- outlier.

(8 marks)

- (b) Table 4 shows data collected in a research on the relationship between monthly income and monthly expenditure of some Kenyans in a particular town. Use it to answer the questions that follow.

**Table 4**

Earners	A	B	C	D	E	F	G	H	J	K
Income	44	65	50	57	96	94	110	34	79	65
Expenditure	41	60	40	50	80	68	84	30	55	48

- Determine the equation of the least squares regression line of expenditure on income. (10 marks)
- Using the regression line obtained in (i) above, estimate the expected amount of expenditure of a Kenyan whose monthly income is Ksh 75,000. (2 marks)

5. (a) Explain each of the following types of errors as used in the collection of statistical data:

- frame error;
- sampling error;
- response error.

(6 marks)

- (b) Table 5 shows the details of activities involved in setting up a computer network. Use it to answer the questions that follow:

**Table 5**

Activity	Preceding Activity	Duration (Weeks)
A	--	10
B	--	12
C	A,B	12
D	A,B	14
E	B	6
F	B	6
G	C	8
H	D,E	10
J	D,E	8
K	F	9
L	G,H	6
M	G,H,J,K	14
N	L,M	5

- (i) Construct a network diagram to represent the activities in the project. (6 marks)
- (ii) Determine the expected project duration and the critical path. (6 marks)
- (iii) Compute the total floats for the non-critical chains of activities. (2 marks)

6. (a) Explain each of the following terms as used in financial calculations:

- (i) lead time;
- (ii) safety stock. (4 marks)

- (b) Differentiate between critical path analysis (CPA) and programme evaluation and review technique (PERT) as used in network analysis. (4 marks)

- (c) Table 6 shows the revenue collection by a municipal council in Kenya for the last three successive years.

**Table 6**

Year	Revenue (in Ksh million)			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2009	40	50	30	26
2010	49	60	40	35
2011	60	72	51	46

Using the multiplicative model and four quarterly moving average:

- (i) determine the seasonal variation for each quarter; (8 marks)
- (ii) estimate the revenue collection for 1st, 2nd, 3rd and 4th quarters of the year 2012. (4 marks)

7. (a) Differentiate between each of the following terms as used in statistical test of hypothesis:

- (i) point estimate and interval estimate;
- (ii) one tailed test and two tailed test. (6 marks)

- (b) A flour milling firm produces two types of flour; maize flour and wheat flour, which have a sale price of Ksh 50 and Ksh 80 per kilogram respectively. The resources used to produce each type of flour and the maximum time available for each task per week is as shown in Table 7.

**Table 7**

	Hours required for each type		
	Transport	Milling	Storage
Maize	3	1	2
Wheat	2	1	1
Maximum hours per week	600	240	300

- (i) Formulate a linear programming (LP) model for the above problem. (3 marks)
- (ii) Using the Simplex method, determine the optimum monthly production plan which maximises sales for the milling firm. (11 marks)

8. (a) Explain the term non-binding constraint as used in linear programming. (2 marks)

(b) Table 8 shows the number of car-jackings experienced by a transport company in a month:

**Table 8**

No. of car-jackings	0	1	2	3
Probability	0.75	0.15	0.08	0.02

(i) Using the following random numbers, simulate the number of car-jackings in a period of 24 months.

Use the following random numbers:

55 82 05 66 61 02 58 91 43 31 90 40 48 64 79 35  
17 62 04 98 63 42 84 33

(7 marks)

(ii) Determine the average monthly rate of carjackings. (1 mark)

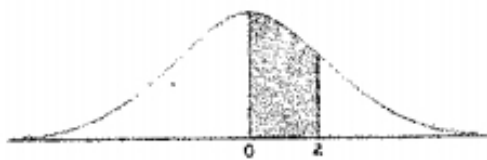
(c) A newspaper vendor buys newspapers at Ksh 15 and sells them at Ksh 20 each respectively. All the newspapers which remain unsold at the end of the day are rendered obsolete and therefore have to be discarded. Table 9 shows the sales records over the last 100 days.

**Table 9**

Newspapers sold	10	12	14	16	18
No. of days	6	15	35	32	12

Determine the optimum stock level which he should hold based on expected monetary value. (10 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	0.083168	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	0.313287
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	0.497366
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



### 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	5.597588	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	2.308004	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	4.436979
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	4.072765
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							