TECHNICAL UNIVERSITY OF MOMBASA

School of Business

Department of Management Science

UNIVERSITY EXAMINATION FOR:

BACHELOR OF COMMERCE, BACHELOR OF BUSINESS ADMINISTRATION

BMS 4203: ADVANCED BUSINESS STATISTICS

END OF SEMESTER EXAMINATION

SERIES: JULY 2025

TIME:2HOURS

DATE: JULY2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

i) In 2024 the per capita consumption of coffee in Kenya was reported to be normally distributed with a mean of 150 Kg and a standard deviation of 8 Kg per annum.

a) What is the probability that a randomly selected person will consume more than 162 kg of coffee? (3 marks)

b) What is the probability that a randomly selected person will consume less than 143 kg of coffee? (3 marks)

c) Find the probability that a randomly selected person will consume between 143 and 162 Kilograms of coffee. (2 marks)

d) Determine the probability that a random sample of 36 people selected from the population will have sample mean greater than 153. (4 marks)

ii) Arrivals to a bank automated teller machine are distributed according to a Poisson distribution with a mean equal to two customers per 10 minutes.

a) Determine the probability that in a given 10-minute segment, no customers will arrive at the ATM. (2 marks)

b) What is the probability that fewer than three customers will arrive in a 10-minute segment? (3 marks)

c) What is the probability that more than two customers will arrive in a 20-minute segment? (3 marks)

iii) Explain the following terms as used in statistics.

a. Type 1 error (2 marks)
b. Type II error (2 marks)
c. Sampling distribution of sample mean (2 marks)
d. A sample. (2 marks)
e. A population. (2 marks)

Question TWO

a) A researcher wishes to determine whether there is a relationship between the gender of an individual and the amount of alcohol consumed. A sample of 68 people is selected and the following data are obtained.

Gender	Alcohol consumption			
	Low	Moderate	High	Total
Male	10	9	8	27
Female	13	16	12	41
Total	23	25	20	68

Required;

(i) State the hypotheses. (2 marks

(ii) Compute the expected values. (3 marks)

(iii) Find the computed chi-square value. (3 marks)

(iv) How many degrees of freedom are there? (1 mark)

(v) Find the critical value of chi-square at $\alpha = 0.05$ (1 mark)

(vi) At $\alpha = 0.10$, can the researcher conclude that alcohol consumption is related to gender? (2 marks)

c) Kenya Airport Authority reported that in 2024, Kenya Airways led all domestic airlines in on-time arrivals for domestic flights, with a rate success rate of 0.8. Using the binomial distribution, what is the probability that in the next six flights:

i. Four flights will be on time? (2 marks)
ii. All six flights will be on time? (2 marks)
iii. At least four flights will be on time? (2 marks)
iv. What is the mean of the number of on-time arrivals? (2 marks)

Question THREE

a) Distinguish between a point estimate and an interval estimate. (4 marks)

b) Discuss three properties of a good estimator. (6 marks)

c) The inspection division of the Mombasa County weights and measures department wants to estimate the actual amount of soft drink in 2-litre bottles at the local bottling plant of a large nationally known soft-drink company. The bottling plant has informed the inspection division that the population standard deviation for 2-litre bottles is 0.05 litre. A random sample of 36 2-litre bottles at this bottling plant indicates a sample mean of 1.99 litres.

(i) Construct a 95% confidence interval estimate of the population mean amount of soft drink in each bottle. (8 marks)

(ii) On the basis of your results, do you think that the purchasers of the soft drink have a right to complain to the soft drink company. (2 marks)

QUESTION FOUR

a) The director of manufacturing at a clothing factory needs to determine whether a new machine is producing a particular type of cloth according to the manufacturer's specifications, which indicate the cloth should have a mean breaking strength of 70 kilograms and a standard deviation of 3.5 kg. A sample of 49 pieces of cloth reveals a sample mean breaking strength of 69.1 kilograms.

Required:

i) State the null and alternative hypothesis. (2 marks)

ii) At the 0.10 level of significance, test the claim that the machine is not meeting the manufacturer's specifications for mean breaking strength? (8 marks)

b) Explain the following terms as used in statistics.

i. A statistic (2 marks)
ii. A parameter (2 marks)
iii. Sampling error (2 marks)
iv. Discrete random variable. (2 marks)
v. Continuous random variable. (2 marks)

Question FIVE

a) A continuous random variable is uniformly distributed between 60 and 80.

i) What is the probability a randomly selected value will be greater than 65? (2marks).

ii) What is the probability that a randomly selected value will be less than 72? (2 marks)

iii) What is the expected value of the random variable? (2 marks)

b) The general manager of a large super market is concerned about the sales behavior of a product sold at the store. He realizes that there are many factors that

might help explain sales, but believes that advertising and price are major determinants. The general manager collected the following data:

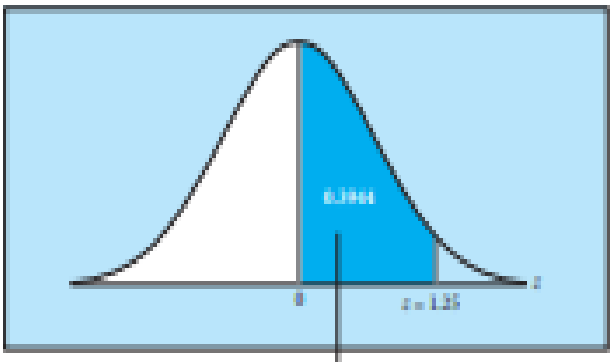
Sales (units sold)	Advertising (number of ads)	Price
33	3	125
61	6	115
70	10	140
82	13	130
17	9	145
24	6	140

Required

i) Calculate the least- squares equation to predict sales from advertising and price.(12 marks)

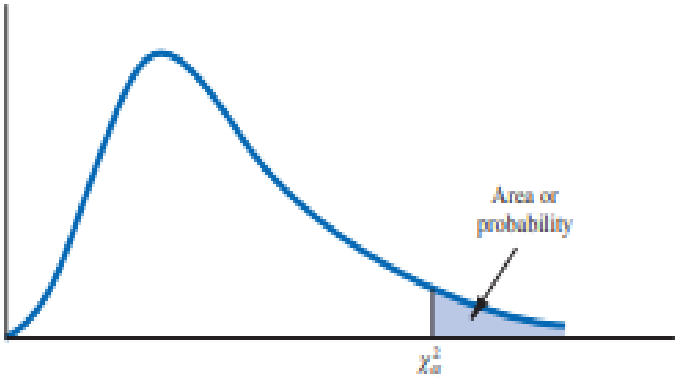
ii) If advertising is 7 and price is sh 32, what sales would you predict? (2marks)

Standard Normal Distribution Table



z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	0.0753
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	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	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	0.2995	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

TABLE 3 CHI-SQUARE DISTRIBUTION



Entries in the table give χ^2_α values, where α is the area or probability in the upper tail of the chi-square distribution. For example, with 10 degrees of freedom and a .01 area in the upper tail, $\chi^2_{.01} = 23.209$.

Degrees of Freedom	Area in Upper Tail									
	.995	.99	.975	.95	.90	.10	.05	.025	.01	.005
1	.000	.000	.001	.004	.016	2.706	3.841	5.024	6.635	7.879
2	.010	.020	.051	.103	.211	4.605	5.991	7.378	9.210	10.597
3	.072	.115	.216	.352	.584	6.251	7.815	9.348	11.345	12.838
4	.207	.297	.484	.711	1.064	7.779	9.488	11.143	13.277	14.860
5	.412	.554	.831	1.145	1.610	9.236	11.070	12.832	15.086	16.750
6	.676	.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.647	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.041	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.558
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.878	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.994
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.335