

245



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2022/2023 ACADEMIC YEAR**  
**FIRST YEAR SECOND SEMESTER**  
**MAIN EXAMINATION**  
**FOR THE DEGREES OF BACHELOR OF EDUCATION**  
**SCIENCE**  
**COURSE CODE: STA 122**

**COURSE TITLE: PROBABILITY AND STATISTICS**

**DATE: 18/4/2023**

**TIME: 2:00 PM - 4:00 PM**

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**INSTRUCTIONS TO CANDIDATES**

*Answer Question One and Any other TWO Questions*

**TIME: 2 Hours**

*This Paper Consists of 6 Printed Pages. Please Turn Over.*

**Question one (30 Marks) COMPULSORY**

- (a) Briefly discuss 4 properties of mathematical expectation. [4 marks]
- (b) Let  $X$  be a random variable and  $Y = 2X + 1$ . What is the variance of  $Y$  if the variance of  $X$  is 5? [2 marks]
- (c) If 20% of the bolts produced by a machine are defective, determine the probability that out of 4 bolts chosen at random,
- (i) 1 bolts will be defective.(2mks)
  - (ii) 0 bolts will be defective.(2mks)
  - (iii) less than 2, bolts will be defective.(2mks)
- (d) The probability distribution function of a discrete random variable  $X$  is

$$f(x) = \begin{cases} 2k, & x = 1 \\ 3k, & x = 3 \\ 4k, & x = 5 \\ 0, & \text{otherwise} \end{cases}$$

Where  $k$  is some constant.

Find,

- i.  $k$  [2 marks]
  - ii.  $P(X > 2)$  [2 marks]
- (e) Find the coefficient of Skewness  $\alpha_3$  and the coefficient of kurtosis  $\alpha_4$  for the data 5, 6, 7, 6, 9, 4, 5 [6 marks]
- (f) Organize the data below into a grouped frequency table. [4 marks]  
112 100 127 120 134 118 105 110 109 112 110 118 117 116 118 122 114 114 105  
109 107 112 114 115 118 117 118 122 106 110 116 108 110 121 113 120 119 111  
104 111 120 113 120 117 105 110 118 112 114 114
- (g) Make a stem and leaf plot of the algebra test scores given below. 56, 65, 98, 82, 64, 71, 78, 77, 86, 95, 91, 59, 69, 70, 80, 92, 76, 82, 85, 91, 92, 99, 73 [4 marks]

**Question Two (20 Marks)**

(a) The probability distribution function of a continuous random variable X is

$$f(x) = \begin{cases} a + bx^2, & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

Where a and b are some constants, Find [10 Marks]

- i. a and b if  $E(X) = \frac{3}{5}$
- ii.  $\text{Var}(x)$

(b) Discuss 10 essentials of a good questionnaire:[10 Marks]

**Question Three (20 Marks)**

a) The number of miles an automobile tire lasts before it reaches a critical point in tread wear can be represented by a pdf

$$f(x) = \begin{cases} \frac{1}{30} e^{-\frac{x}{30}}, & \text{for } x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the expected number of miles (in thousands) a tyre would last until it reaches the critical tread wear point. [10 Marks]

b) The data given below are obtained from student records. (Grade Point Average (x) and Graduate Record exam score (y)) Calculate the rank correlation coefficient 'R' for the data. [10 Marks]

Subject	1	2	3	4	5	6	7	8	9	10
X	8.3	8.6	9.2	9.8	8.0	7.8	9.4	9.0	7.2	8.6
y	2300	2250	2380	2400	2000	2100	2360	2350	2000	2260

**Question Four (20 Marks)**

- a) Establish the validity of the Poisson approximation to the binomial distribution. (10 mks)
- b) Scores made by students in a statistics class in the mid-term and final examination are given in the table below. Develop a regression equation then use it to find the projected or

estimated final scores of the students whose midterm score is 50 and comment about it. [10 Marks]

Student	1	2	3	4	5	6	7	8	9	10
Mid term	98	66	100	96	88	45	76	60	74	82
Final	90	74	98	88	80	62	78	74	86	80

**Question Five (20 Marks)**

a) One bag contains 4 white balls and 2 black balls; another contains 3 white balls and 5 black balls. If one ball is drawn from each bag, find the probability that

- (i) both are white, (2mks)
- (ii) both are black, (2mks)
- (iii) one is white and one is black.(2mks)

b) Box *I* contains 3 red and 2 blue marbles while Box *II* contains 2 red and 8 blue marbles. A fair coin is tossed. If the coin turns up heads, a marble is chosen from Box *I*; if it turns up tails, a marble is chosen from Box *II*.

- i. Find the probability that a red marble is chosen. (2mks)
- ii. Suppose that the one who tosses the coin does not reveal whether it has turned up heads or tails (so that the box from which a marble was chosen is not revealed) but does reveal that a red marble was chosen. What is the probability that Box *I* was chosen (i.e., the coin turned up heads)? (2mks)

c) Using simple average of Price Relative Method find the price index for 2001, taking 1996 as base year from the following data: [10 Marks]

Commodity	Wheat	Rice	Sugar	Ghee	Tea
Price (in 1996) per unit	12	20	12	40	80
Price (in 2001) per unit	16	25	16	60	96

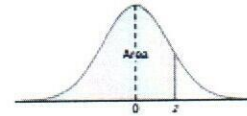


Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

