KENYATTA UNIVERSITY

EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN MEDICAL LABORATORY SCIENCE

HSU 826: MEDICAL BIOSTATISTICS

1ST SEMESTER 2022/2023 **TIME:3 Hours**

INSTRUCTIONS:

Answer any THREE of the following FOUR Questions

1. a) Riziki et al observed that 12 percent of adults in her County had taken COVID-19 Vaccine Consider a simple random sample of 40 adults selected at that time and find the probability that the number of adults who had taken the vaccine would be:

   i. Five (2 Marks)

   ii. Between three and seven inclusive (3 Marks)

   iii. More than four (3 Marks)

   iv. Less than five (4 Marks)

   b) Consolate a research analyst, did an analysis of variance and produced an ANOVA table entries shown below

Source of Variation	Sum of Square	DF	Mean Square	F
Between	35.2	2		
Within				
Total	1055.7	11		

Tabulated value= F (0.01)

   i. Complete the ANOVA table (5 Marks)

   ii Using the information and after completing the ANOVA table, Test the Null hypothesis that there was no difference between the habitats? (3 Marks)

   c) Baraka et al found that a number of serious allergies reported to the Committee on Safety of Medicine with an average of 7 allergic reactions per 1000 prescriptions of an allergic drug. Using a Poisson model for probability, find the probability that;

i. Exactly 6 allergic reactions in 1000 prescriptions (2 Mai.

ii. No allergic reactions in 1000 prescriptions (3 Marks)

iii. At most four allergic reactions in 1000 prescriptions (3 Marks)

iv. At least three allergic reactions in 1000 prescriptions (2 Marks)

2. a) In a cetain population, an average of 13 new cases of esophargeal cancers were diagnosed each year through a study by Naesae et al., If the annual incidence of esophargeal cancer follows a poissons distribution, find the probability that in a given year, the nuber of newly esophargeal cancer cases will be

i. 10 (2 Marks)

ii Not more than 12 (6 Marks)

iii Between 9 and 15, Inclusive (7 Marks)

iv. At least 8 (5 Marks)

b) Sofia et al compared the total cholesterol levels (mg/dl) between among patients with primary hypertension (PH) by 2 machines. She presented her data in the following table.

Machine 1	206	196	189	203	225	221	231	223	236
	208	265	203	199					
Machine 2	168	229	196	212	203	121	163	189	196
	142	179	212	239					

i. Calculate the correlation coefficient (r). (4 marks)

ii. Comment on (r). (1 mark)

iii. Can we conclude that the two methods on the 13 patients have different cholesterol levels or not? (5 marks)

3. a) Fatuma observed that 10% of Children under 5 years in Maganyakulo sub county had been given BCG vaccines. Considering a random selection of 40 children, find the probability using Binomial distribution model that the number of children who take vaccine will be between 5 and 8 (Inclusive). (6 marks)

b) Tima carried out a study to test the effectiveness of 3 drugs a, b and a combination of drug a and b using 3 samples of ~~1000~~ 1200 patients. The 1st group of 200 people were. Given drug a, the 2nd group of 500 people were given drug b while the 3rd group of 500 people were given a combination of drug a and b. Results were as shown below:

b) Kanze did a study and obtained the following results.

Total number of births registered 1000

Low birth weights 72 (<2500g),

158 had mothers who abused alcohol during pregnancy,

Out of the mothers who abused alcohol during pregnancy, 19 gave birth to babies with low birth weight

i. Calculate the Absolute Risk, Relative Risk (RR) and Attributable Risk (6 marks)

ii. Using relevant examples explain the differences between Rate, Ratio and Proportion (6 marks)

iii. Interpret the RR results above (4 marks)

4. a) Describe experimental designs (15 marks)

b) Faraja investigated the association between Pneumococcus carinii pneumonia infection and Deaths in a group of 227 patients with end stage renal disease over a 6 months followup period. Patients were divided into 2 groups according to the presence or absence of the bacteria for the Pneumonia. The results were as shown below

Pneumocystis carinii Pneumonia	Total at start of the study	No. of Deaths	No. of Survivors
Positive	89	38	51
Negative	138	40	98

i. Using appropriate measure of association determine the relationship between Pneumocystis carinii pneumonia and Deaths (8 marks)

ii. Giving reasons, suggest the study design used (4 marks)

iii. State any two strengths and one limitation of the study design in (a) above (3 marks)

$$\chi^2 = \frac{\Sigma (O-E)^2}{E}$$

$$b = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$$

$$Z = \frac{x - \mu}{\sigma}$$

- $$F(x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$$e = 2.7183$$

$$a = \frac{\Sigma y - b \Sigma x}{n}$$

$$a = \bar{y} - b\bar{x}$$

- $$r = \frac{\Sigma y_1 y_2 - \frac{\Sigma y_1 \cdot \Sigma y_2}{n}}{\sqrt{\Sigma y_1^2 - \frac{(\Sigma y_1)^2}{n} \cdot \Sigma y_2^2 - \frac{(\Sigma y_2)^2}{n}}}$$

$$P(x) = {}^nC_x \, p^x q^{n-x}$$

$$t \text{ calc.} = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$$

AREAS UNDER THE STANDARD NORMAL CURVE

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

VALUES OF THE CHI-SQUARE DISTRIBUTION

df	.10	.05	.025	.010	.005	.001
1	2.706	3.841	5.024	6.635	7.879	10.83
2	4.605	5.991	7.378	9.210	10.60	13.82
3	6.251	7.815	9.348	11.34	12.84	16.27
4	7.779	9.488	11.14	13.28	14.86	18.47
5	9.236	11.07	12.83	15.09	16.75	20.52
6	10.64	12.59	14.45	16.81	18.55	22.46
7	12.02	14.07	16.01	18.48	20.28	24.32
8	13.36	15.51	17.53	20.09	21.95	26.12
9	14.68	16.92	19.02	21.67	23.59	27.88
10	15.99	18.31	20.48	23.21	25.19	29.59
11	17.28	19.68	21.92	24.73	26.76	31.26
12	18.55	21.03	23.34	26.22	28.30	32.91
13	19.81	22.36	24.74	27.69	29.82	34.53
14	21.06	23.68	26.12	29.14	31.32	36.12
15	22.31	25.00	27.49	30.58	32.80	37.70
16	23.54	26.30	28.85	32.00	34.27	39.25
17	24.77	27.59	30.19	33.41	35.72	40.79
18	25.99	28.87	31.53	34.81	37.16	42.31
19	27.20	30.14	32.85	36.19	38.58	43.82
20	28.41	31.41	34.17	37.57	40.00	45.31
21	29.62	32.67	35.48	38.93	41.40	46.80
22	30.81	33.92	36.78	40.29	42.80	48.27
23	32.01	35.17	38.08	41.64	44.18	49.73
24	33.20	36.42	39.36	42.98	45.56	51.18
25	34.38	37.65	40.65	44.31	46.93	52.62
26	35.56	38.89	41.92	45.64	48.29	54.05
27	36.74	40.11	43.19	46.96	49.64	55.48
28	37.92	41.34	44.46	48.28	50.99	56.89
29	39.09	42.56	45.72	49.59	52.34	58.30
30	40.26	43.77	46.98	50.89	53.67	59.70
40	51.81	55.76	59.34	63.69	66.77	73.40
50	63.17	67.50	71.42	76.15	79.49	86.66
60	74.40	79.08	83.30	88.38	91.95	99.61
70	85.53	90.53	95.02	100.4	104.2	112.3
80	96.58	101.9	106.6	112.3	116.3	124.8
90	107.6	113.1	118.1	124.1	128.3	137.2
100	118.5	124.3	129.6	135.8	140.2	149.4

VALUES OF THE t- DISTRIBUTION

t	.25	.10	.05	.025	.01	.005
1	1.000	3.078	6.314	12.71	31.82	63.66
2	0.816	1.886	2.920	4.303	6.965	9.925
3	0.765	1.638	2.353	3.182	4.541	5.841
4	0.741	1.533	2.132	2.776	3.747	4.604
5	0.727	1.476	2.015	2.571	3.365	4.032
6	0.718	1.440	1.943	2.447	3.143	3.707
7	0.711	1.415	1.895	2.365	2.998	3.499
8	0.706	1.397	1.860	2.306	2.896	3.355
9	0.703	1.383	1.833	2.262	2.821	3.250
10	0.700	1.372	1.812	2.228	2.764	3.169
11	0.697	1.363	1.796	2.201	2.718	3.106
12	0.695	1.356	1.782	2.179	2.681	3.055
13	0.694	1.350	1.771	2.160	2.650	3.012
14	0.692	1.345	1.761	2.145	2.624	2.977
15	0.691	1.341	1.753	2.131	2.602	2.947
16	0.690	1.337	1.746	2.120	2.583	2.921
17	0.689	1.333	1.740	2.110	2.567	2.898
18	0.688	1.330	1.734	2.101	2.552	2.878
19	0.688	1.328	1.729	2.093	2.539	2.861
20	0.687	1.325	1.725	2.086	2.528	2.845
21	0.686	1.323	1.721	2.080	2.518	2.831
22	0.686	1.321	1.717	2.074	2.508	2.819
23	0.685	1.319	1.714	2.069	2.500	2.807
24	0.685	1.318	1.711	2.064	2.492	2.797
25	0.684	1.316	1.708	2.060	2.485	2.787
26	0.684	1.315	1.706	2.056	2.479	2.779
27	0.684	1.314	1.703	2.052	2.473	2.771
28	0.683	1.313	1.701	2.048	2.467	2.763
29	0.683	1.311	1.699	2.045	2.462	2.756
30	0.683	1.310	1.697	2.042	2.457	2.750
40	0.681	1.303	1.684	2.021	2.423	2.704
60	0.679	1.296	1.671	2.000	2.390	2.660
120	0.677	1.289	1.658	1.980	2.358	2.617
∞	0.674	1.282	1.645	1.960	2.326	2.576

VALUES OF F-DISTRIBUTION

RIGHT TAIL OF THE DISTRIBUTION FOR P = .05
RIGHT TAIL OF THE DISTRIBUTION FOR P = .01 (IN BRACKETS)

n_2 = Degrees of Freedom for Denominator	n_1 = Degrees of Freedom for Numerator: 1	2	3	4	5	6	7	8	9	10	11	12
1	161 (4,052)	200 (4,999)	216 (5,403)	225 (5,625)	230 (5,764)	234 (5,859)	237 (5,928)	239 (5,981)	241 (6,022)	242 (6,056)	243 (6,082)	244 (6,106)
2	18.51 (98.49)	19.00 (99.01)	19.16 (99.17)	19.25 (99.25)	19.30 (99.30)	19.33 (99.33)	19.36 (99.34)	19.37 (99.36)	19.38 (99.38)	19.39 (99.40)	19.40 (99.41)	19.41 (99.42)
3	10.13 (34.12)	9.55 (30.81)	9.28 (29.46)	9.12 (28.71)	9.01 (28.24)	8.94 (27.91)	8.88 (27.67)	8.84 (27.49)	8.81 (27.34)	8.78 (27.23)	8.76 (27.13)	8.74 (27.05)
4	7.71 (21.20)	6.94 (18.00)	6.59 (16.69)	6.39 (15.98)	6.26 (15.52)	6.16 (15.21)	6.09 (14.98)	6.04 (14.80)	6.00 (14.66)	5.96 (14.54)	5.93 (14.45)	5.91 (14.37)
5	6.61 (16.26)	5.79 (13.27)	5.41 (12.06)	5.19 (11.39)	5.05 (10.97)	4.95 (10.67)	4.88 (10.45)	4.82 (10.27)	4.78 (10.15)	4.74 (10.05)	4.70 (9.96)	4.68 (9.89)
6	5.99 (13.75)	5.14 (10.92)	4.76 (9.78)	4.53 (9.15)	4.39 (8.75)	4.28 (8.47)	4.21 (8.26)	4.15 (8.10)	4.10 (7.98)	4.06 (7.87)	4.03 (7.79)	4.00 (7.72)
7	5.59 (12.25)	4.74 (9.55)	4.35 (8.45)	4.12 (7.85)	3.97 (7.46)	3.87 (7.19)	3.79 (7.00)	3.73 (6.84)	3.68 (6.71)	3.63 (6.62)	3.60 (6.54)	3.57 (6.47)
8	5.32 (11.26)	4.46 (8.65)	4.07 (7.59)	3.84 (7.01)	3.69 (6.63)	3.58 (6.37)	3.50 (6.19)	3.44 (6.03)	3.39 (5.91)	3.34 (5.82)	3.31 (5.74)	3.28 (5.67)
9	5.12 (10.56)	4.26 (8.02)	3.86 (6.99)	3.63 (6.42)	3.48 (6.06)	3.37 (5.80)	3.29 (5.62)	3.23 (5.47)	3.18 (5.35)	3.13 (5.26)	3.10 (5.18)	3.07 (5.11)
10	4.96 (10.04)	4.10 (7.56)	3.71 (6.55)	3.48 (5.99)	3.33 (5.64)	3.22 (5.39)	3.14 (5.21)	3.07 (5.06)	3.02 (4.95)	2.97 (4.85)	2.94 (4.76)	2.9 (4.71)
11	4.84 (9.65)	3.98 (7.20)	3.59 (6.22)	3.36 (5.67)	3.20 (5.32)	3.09 (5.07)	3.01 (4.88)	2.95 (4.74)	2.90 (4.63)	2.86 (4.54)	2.82 (4.46)	2.79 (4.40)
12	4.75 (9.33)	3.88 (6.93)	3.49 (5.95)	3.26 (5.41)	3.11 (5.06)	3.00 (4.82)	2.92 (4.65)	2.85 (4.50)	2.80 (4.39)	2.76 (4.30)	2.72 (4.22)	2.69 (4.16)