KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN PUBLIC HEALTH
FIRST SEMESTER 2022/2023
[JAN – APRIL, 2023]

PHES 405: APPLIED BIOSTATISTICS

STREAM: Y4 S1 **TIME: 3 HOURS**

DAY: WEDNESDAY, 9:00 – 12:00 P.M. **DATE: 29/03/2023**

INSTRUCTIONS:

1. ***Do not write anything on this question paper.***
2. ***Answer question ONE (Compulsory) and any other TWO questions.***

QUESTION ONE-25 MARKS

a) Define Biostatistics [2 Marks]
b) State and explain two types of data [4 Marks]
c) Differentiate between Type I error and Type II error. [4 Marks]
d) A new drug is being developed by a pharmaceutical company for the treatment of lung cancer. The company will release the drug only if a clinical trial indicates that it is effective on a majority of lung cancer patients. The company's scientists are confident that the drug is effective, but they wish to make the claim based on the statistical evidence. Let p be the proportion of lung cancer patients for whom the drug is effective. How would you state the hypotheses? [5 Marks]
e) A random sample of 120 recorded deaths in the United states during the past year showed an average of 80.9 years. Assuming a population standard deviation of 6.5 years, does this seem to indicate that the mean life span is greater than 80 years? Use $\alpha=0.05$. [5 Marks]

f) Researchers wish to know if the data they have collected provide sufficient evidence to indicate a difference in mean serum uric acid levels between normal individuals and individuals with Down's syndrome. The

data consist of serum uric acid readings on 20 individuals with Down's syndrome and 22 normal individuals. The means are $x_1 = 4.6\text{mg}/100$ ml and $x_2 = 3.4mg/100ml$. Use $\alpha = 0.01$ [5 Marks]

QUESTION TWO-15 MARKS

a) A sports trainer wants to know whether the true average time of his athletes who do 100 metre sprint is 99 seconds. He recorded 15 trials of his team and found that the average time is 98.3 seconds with a standard deviation of 0.4 seconds. Do we reject his null hypothesis that $\mu = 99$ at $\alpha = 0.05$? [3 Marks]

b) The following are the head circumferences (centimeters) at birth of 20 infants:

33.30	33.80	33.30	33.85	33.51	33.70	33.03	33.71	33.42	33.58
33.41	33.35	33.10	33.38	33.78	33.85	33.44	33.09	33.07	33.67

We wish to test $H_o: \mu = 34.5$ against $H_a: \mu \neq 34.5$. [12 Marks]

QUESTION THREE-15 MARKS

The table below contains 10 cases of Mother's weight in Kg (Y) and infants birth weight in Kg (X).

Y	59.7	65.5	63.4	60.9	63.6	66.0	60.5	67.8	55.7	64.1	60.2	62.8
X	3.5	3.4	3.4	3.2	3.7	3.3	3.7	3.9	3.7	3.0	3.8	3.7

a) Fit the least squares regression equation relating the Mother's weight (Y) to the infant's weight (X). [8 Marks]

b) Calculate the correlation coefficient for your data. Comment on your result. [7 Marks]

QUESTION FOUR-15 MARKS

a) What is the test for means? [2 Marks]
b) What are the four types of t tests? [4 Marks]
c) A random sample of 12 babies born at Kisii referral hospital had their weights as follows;

2.4	2.1	3.0	2.2	2.7	2.1
2.5	2.4	2.4	2.7	2.3	2.9

Assuming that the sample came from a normal population, investigate the claim that the mean is greater than 2.5kg. Use $\alpha = 0.05$.

[9 Marks]

QUESTION FIVE-15 MARKS

a) Analysis of amniotic fluid from a simple random sample of 16 pregnant women yielded the following measurements on total protein (grams per 100ml) present:

0.67	0.70	0.78	0.82	0.79	0.85	0.87	0.71
0.84	0.73	0.64	0.86	0.80	0.73	0.61	0.60

Do these data provide evidence that the population variance is greater that 0.75? Use $\alpha = 0.05$. [7 Marks]

b) A researcher was interested in knowing if preterm infants with late metabolic acidosis and preterm infants without the condition differ with respect to urine levels of a certain chemical. The mean levels, standard deviations, and sample sizes for the two samples studied were as follows:

Sample	n	$\bar{x}$	S
With condition	35	8.5	5.5
Without condition	40	4.8	3.6

What should the researcher conclude on the basis of these results? Use $\alpha = 0.05$ [8 marks]

z	0.00	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
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998

STUDENT T TABLE

df\p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	4.3178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
∞	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905