UGANDA MARTYRS UNIVERSITY
NKOZI

UNIVERSITY EXAMINATIONS
July 2022

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCES

STATISTICAL METHODS

Course: BSC. Econ. & STAT. III

DATE: Monday, 19/7/2022

TIME: 9:30 – 12:30 Pm

DURATION: 3 HRS

VENUE: ROOM 11

Instructions:

1. *Carefully read through ALL the questions before attempting*
2. ***ANSWER Four (4) Questions.*** *(Each question carries equal marks)*
3. *No* **names** *should be written anywhere on the examination book.*
4. *Ensure that your* **ID number** *is indicated on all pages of the examination answer booklet.*
5. *Ensure your work is* **clear** *and* **readable***. Untidy work shall be penalized*
6. *Any type of examination Malpractice will lead to automatic disqualification*
7. *Do not write anything on the questions paper.*

Question 1

a) State Chebyshev's theorem. [**02marks**]

b) An experiment was performed such that the average was found to be 25kgs. If the standard deviation was found to be 2 kgs. Determine in terms of percentage will be obtained that will lie between 20kg and 30kgs. [**08 marks**]

c) A normal distribution has a mean of 40, and 15% of the values are above 45. What is the standard deviation? [**05marks**]

d) At a factory, bulbs are produced with a standard deviation of 2.0 months. In a sample of 100 bulbs, the mean life expectancy is 12.5. Find a 99% confidence interval estimate for the life expectancy of all bulbs produced at the plant. [**10marks**]

Question 2

a) **(i)** State central limit theorem [**02 marks**]

(ii) A business man's profits in a certain month had a mean of $50 with a standard deviation of $10. What is the probability that a sample of 100 businesses will have a mean profit of over $60? [**05 marks**]

b) (i) Define the term P-value [**02 marks**]

(ii) A drug company claims that their medication will render a patient unconscious in an average of 10 minutes. A researcher decides to test this claim with 200 patients. He obtains the following data: $\sum x = 2789$ and $\sum(x - x)^2 = 3128$. Should the drug company's claim be rejected at a level of 5% significance? [**10marks**]

c) A poll claims that during Covid-19 lock down, children spent an average of 200 minutes per day watching television. A researcher believes this is too high and conducts a study of 100 children. The sample standard deviation is 80 minutes. He will reject the 30 claim if the sample mean is less than 150 minutes per day. What is the probability of a Type II error if the actual average is 200? [**06 marks**]

Question 3

a) Define the following as applied to statistical methods;
   (i) Statistical hypothesis
   (ii) Level of significance
   (iii) Critical value
   (iv) Test value [**02 marks @**]

b) (i) State the difference between type I error and type II error as used in testing hypothesis. [**02 marks**]

(ii) Explain the steps that can be involved in hypothesis testing. [**04 marks**]

c) A study claims that the average cost of a hotel room in Kampala is Ugx. 69,201. To test the claim, a researcher selects a sample of 30 hotel rooms and finds that the average cost is Ugx. 68,430. If the standard deviation is Ugx. 3,720 and at $\alpha = 0.05$.

(i) Test the hypothesis that $Ho: \mu = 69,210$, $Ha: \mu \neq 69,210$. [**10 marks**]

(ii) Would you reject the claim? Give a reason for your answer. [**01 marks**]

Question 4

a) A stock market analyst wants to estimate the average return on a certain stock. A random sample of 15 days yields an average return of 10.37% and a standard deviation of 3.5%. Assuming a normal population of returns, give a 95% confidence interval for the average return on this stock. [**07 marks**]

b) A standard statistical methods test was given to 50 girls and 75 boys. The girls made an average grade of 76% with a standard deviation of 6% while the boys made an average grade of 82% with the standard deviation of 8%. Find a 99% confidence interval for the difference of average marks [**08 marks**]

c) In a contest sponsored by Coca-Cola Ltd, you can win a prize if the cap on your bottle of sodas says "WINNER"; however, you may only claim one prize. Mujuni preparing to win, blows all his savings on sodas; as a result, has a 0.10% chance of winning $1,500,000, a 5% chance of winning $500,000, and a 60% chance of winning $10.00. Ignoring the money you spent on sodas, what is the expected value and standard deviation? [**10 marks**]

Question 5

a) State where a chi-square test is appropriate in statistical testing [**05 marks**]

b) A random sample of 400 house holders is classified by two characteristics. Whether they own a colour television and by what type of householder say [owned- occupier, private-tenant, and council-tenant]. The results of this investigation are given below.

	Actual frequencies			
	owned- occupier	private-tenant	council-tenant	Total
Colour - TV	150	60	20	230
No colour - TV	45	68	57	170
Total	195	128	77	400

(i)   Generate a table of expected frequencies from the above information, [**10 marks**]

(ii)   It is required to test at the 5% level, the following hypothesis,

Ho: The two classifications are independent.(no relationship between classes of householder and colour TV ownership)

Ha: The classifications are not independent. [**10 marks**]

Question 6

a) Define the following terms as applied to statistical testing;
(i)   Null hypothesis
(ii)   Alternative non-directional hypothesis
(iii)   Alternative directional hypothesis [02 marks @]

b) A survey was carried out in a firm of the smoking habits of men and women employees with the following results

	Men	Women
Smokers	48	27
Non-smokers	58	57

It is required to test whether, at the 5% level of significance, the survey reveals any difference in the smoking habits of men and women. [10 marks]

c) Investing in Computer business has a 70% chance of resulting in a $70,000 gain and a 30% chance of resulting in a $30,000 loss. Determine the expected value of investing in computer business. [09 marks]

END

Half table for determining the proportion under any chosen section of the normal curve.
[The standard distribution table is symmetrical about the centre.]

This table applies to the green area in the graph to the right

Deviation (distance) Z
from the mean (average) at 0
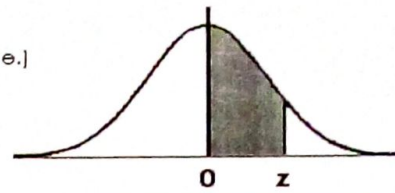
Z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.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
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

Chi square table

Degrees of freedom	Probability (alpha) that the tabulated value is exceeded			
	0.10	0.05	0.01	0.001
1	2.71	**3.84**	6.63	**10.83**
2	4.61	5.99	9.21	13.82
3	6.25	7.81	11.34	16.27
4	7.78	9.49	13.28	18.47
5	9.24	11.07	15.09	20.52
6	10.64	12.59	16.81	22.46
7	12.02	14.07	18.48	24.32
8	13.36	15.51	20.09	26.13
9	14.68	16.92	21.67	27.88
10	15.99	18.31	23.21	29.59
11	17.28	19.68	24.73	31.26
12	18.55	21.03	26.22	32.91