UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN

INFORMATION TECHNOLOGY

COURSE CODE: **STA 225**

COURSE TITLE: **STATISTICS AND PROBABILITY II**

DATE: 27/04/2023   **TIME:** 9 AM -11 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Differentiate between a statistic and a parameter (4 marks)

b) i) Define an event as used in statistics and probability (2 marks)

ii) State and describe types of probability events (6 marks)

c) State the characteristic of a good estimator (3 marks)

d) 15% of items in a department store are believed to be defective. If 12 items are picked randomly, what is the probability that;

i) None will be defective (2 marks)

ii) Exactly 2 will be defective (2 marks)

iii) Exactly 8 will be good (2 marks)

iv) At most 3 are defective (2 marks)

v) Expected number of defective items (2 marks)

e) Outline steps for carrying out a hypothesis test (5 marks)

QUESTION TWO (20 MARKS)

a) State the three axioms of probability (3 marks)

b) A particular test for whether a student has used meth is 90% sensitive. The test is also 75% accurate. If 5% of students in the IT class use meth, what is the probability that a student picked at random actually used meth if the student tests positive? (5 marks)

c) A bag contains 20 balls; 3 red balls, 6 green balls, 4 blue balls, 2 white balls, and 5 yellow balls. One ball is selected at random

Find the probability that:

i) The ball is either red or green (2 marks)

ii) The ball is not blue (2 marks)

iii) The ball is either green or yellow or blue (2 marks)

d) Suppose that a fair coin is tossed twice so that the sample space is S = {HH, HT, TH, TT}. Let x be the number of heads. Find the probability function of x and the cumulative distribution of x. (6 marks)

QUESTION THREE (20 MARKS)

a) State the characteristics of a normal distribution curve (4 marks)

b) The lifespan of a flashlight is normally distributed with mean 150 hours and standard deviation of 15 hours. The flashlight will cease to function if one of more of its batteries fails. Find the probability that the flashlight will last for:

i) At most 130 hours (2 marks)

ii) At least 145 hours (2 marks)

iii) Between 140 hours and 155 hours (3 marks)

If there are 800 similar flashlights in a certain metropolitan, how many flashlights will last for more than 160 hours? (4 marks)

c) In tossing 3 fair coins, let the random variable x be defined as $x =$ number of tails. The variable x can assume values 1, 2, and 3. Find the probabilities associated with values of x

(5 marks)

QUESTION FOUR (20 MARKS)

a) Discuss two main situations when $\chi 2$ significance test is used. (4 marks)

b) The table below shows the number of employees absent for one day during a particular period of time.

Day of the Week	Monday	Tuesday	Wednesday	Thursday	Friday
Number of Absentees	121	87	87	91	114

Given that the expected number of absentees for any day is 100, find the frequencies expected according to the hypothesis that the number of absentees is independent of the day of the week (10 marks)

c) The mean life of a sample of 100 flourescent light bulbs produced by a company is computed to 1570 hours with a standard deviation of 120 hours. If μ is the mean life of all the bulbs produced by the company, test the hypothesis $\mu = 1600$ hours against the alternative $\mu \neq 1600$ hours. (*Take* $\alpha = 0.01$). (6mks)

QUESTION FIVE (20 MARKS)

(a) Two sources of raw materials are under consideration by a company. Both sources seem to have similar characteristics but the company is not sure of their respective uniformity. A sample of 10 lots from source A yielded a variance of 225 and a sample of 11lots from source B yielded a variance of 200. Is it likely that the variance of source A is significantly greater than that of source B at $\alpha = 5\%$ (5mks)

(b) Workers at Tororo Cement Limited with four factories were subjected to three new performance enhancing drugs A, B and C. In each factory, three workers were identified randomly each one of them received one of the drugs. Their performance (average number of bags of cement handled per hour) was recorded:

	Group 1 (Drug A)	Group 2 (Drug B)	Group 3 (Drug C)
Factory 1	15	12	19
Factory 2	27	25	12
Factory 3	24	29	30
Factory 4	32	31	29

Required

(i)   Based on the above information, construct an ANOVA Table

(ii)   Test whether there is some significant difference in variance in performance within the groups and between the groups. (Take $\alpha = 0.01$)   (15mks)