

DECEMBER 2021
EBS 351SW
STATISTICS AND PROBABILITY II
2 HOURS

Candidate's Index Number:
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
ONE-YEAR THREE-SEMESTER BACHELOR OF EDUCATION
COHORT I, LEVEL 300, END-OF-SECOND SEMESTER EXAMINATION – DECEMBER 2021

DECEMBER 24, 2021 STATISTICS AND PROBABILITY II 2:00 PM – 2:40 PM

This paper consists of two sections, A and B. Answer ALL the questions in Section A and THREE questions from Section B. Section A will be collected after the first 40 minutes.

SECTION A
(40 MARKS)

Answer ALL the questions in this Section.

For items 1 to 10, each stem is followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

1. A bag contains 8 black and 6 white balls which are similar. If two balls are picked at random from the bag one after the other without replacement, find the probability that the balls picked are all black.

- A. $\frac{4}{13}$
- B. $\frac{16}{49}$
- C. $\frac{9}{49}$
- D. $\frac{15}{91}$

2. In a competitive interview for placement in some duty-post, five applicants were ranked by two interviewers as:

Applicant	A	B	C	D	E
Rank by interviewer 1	5	4	2	4	3
Rank by interviewer 2	4	1	4	3	1

The coefficient of rank correlation is

- A. 0.1
- B. 0.2
- C. 0.3
- D. 0.4

Use the set $\{0, 1, 2, 3, 4\}$ to answer questions 3 to 5.

3. How many five-digit numbers can be formed if each number is used once?
A. 48
B. 60
C. 86
D. 96
4. How many four-digit numbers can be formed if each number is used once?
A. 48
B. 60
C. 86
D. 96
5. How many of the four-digit numbers are less than 2000?
A. 24
B. 48
C. 55
D. 60
6. The mean age of two boys is 10 years and the mean age of three girls is 15 years. Calculate the mean age of the five children.
A. 10 years
B. 11 years
C. 12 years
D. 13 years
7. A bag contains 7 black and 4 white identical balls and if two balls are drawn at random, one after the other without replacement, find the probability that at least one ball is white.
A. $\frac{2}{11}$
B. $\frac{3}{11}$
C. $\frac{4}{11}$
D. $\frac{5}{11}$
8. The probability distribution function of a discrete random variable X is presented in the table below:

X	0	1	2	3
Probability(X)	$\frac{1}{8}$	$\frac{3}{8}$	p	$\frac{1}{8}$

Find the value of p .

- A. $\frac{1}{8}$
B. $\frac{1}{4}$
C. $\frac{3}{8}$
D. $\frac{1}{2}$

9. In a sample of five measurements, the diameter of a sphere was recorded in mm by a scientist as 63.3, 63.7, 63.6, 63.2, and 63.7.

Determine the unbiased and efficient estimate of the true mean.

- A. 63.5
 - B. 63.6
 - C. 63.8
 - D. 65.3
10. Given that x is normally distributed with mean 6 and variance 2.25, calculate the probability that $3.5 < x < 6.9$.
- A. 0.2258
 - B. 0.3551
 - C. 0.5809
 - D. 0.8564

For questions 11 to 15, show working in the space provided under each item. Each question carries 4 marks.

11. If A and B are two events such that $p(A) = 0.3$, $p(B) = 0.6$ and $p(A \cup B) = 0.72$. Determine whether or not A and B are independent events.

12. A continuous random variable x has a probability density function (p.d.f)

$$f(x) = kx^2 \text{ for } 0 \leq x \leq 4$$

Find the value of k .

13. If two events A and B are mutually exclusive such that $P(A) = \frac{2}{3}$ and $P(B) = \frac{1}{5}$, find $P(A \cup B)$.

14. Calculate the variance of the following set of numbers 6, 7, 9, 11 and 12.

15.

<i>Mathematics</i>	3	4	2	1
<i>Physics</i>	4	3	1	2

The marks scored by 4 students in Mathematics and Physics are ranked as showed in the table. Calculate, correct to one significant figure, the Spearman's rank correlation coefficient.

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SECTION B
(60 MARKS)

Answer only **THREE** questions from this Section. Each question carries **20** marks.

1.

- a. i. The percentage shrinkage in samples of cloth after washing in directions along and across the cloth are presented in the following table:

Along(x)	12	4	10	10	11	10	6	6	13
Across(y)	5	2	5	8	6	8	3	4	5

Find the equation of line of regression of x on y .

(13 Marks)

- ii. A roll of cloth is sampled by cutting a narrow test strip across the roll. The strip shows a percentage shrinkage of 7. Use your regression equation to obtain an estimate of the percentage to be expected along the cloth.

(2 Marks)

- b. In the past, a machine has produced washers having a thickness of 0.50 mm. To determine whether the machine is in proper working condition, a sample of 10 washers is selected from the production for which the mean thickness is found to be 0.53 mm with a standard deviation of 0.03 mm. Test the hypothesis that the machine is in proper working condition using significance level of 5%.

(5 Marks)

2.

- a. An examination was given to two groups of students consisting of 100 and 120 respectively. In the first group, a random sample of 41 students were selected with a mean score of 75 and a standard deviation of 7. Again, a sample of 51 students with mean score of 79 with standard deviation of 8 we selected. Test the hypothesis to find out whether these two groups differ in performance significantly at 5%.

[14 Marks]

- b. A box contains 6 blue and 4 red similar balls and another box contains 5 blue and 3 red similar balls. If two balls are drawn at random, one from each box, find the probability that:
- i. both are blue [2 Marks]
 - ii. one is blue and one is red [4 Marks]

3.

- a. The deviations of a set of numbers from 45 are $-5, -3, -1, 0, 1, 3, 5$ and 7 . Calculate the:
- i. mean of the numbers; [8 Marks]
 - ii. variance of the numbers. [3 Marks]
- b. The probabilities that three girls win their respective races are $\frac{1}{3}, \frac{3}{5}$ and m .
If the probability that only one of them wins her race is $\frac{1}{3}$, find the value of m . [9 Marks]

4.

- a. A box contains 60 balls of which x are blue and the rest are green. If the probability of selecting a green ball is $\frac{3}{5}$, find the value of x . [7 Marks]
- b. In a certain examination, the probability that Kofi, Ama and Yaw would pass are $\frac{1}{3}, \frac{2}{3}$ and $\frac{3}{4}$ respectively. Calculate the probability that:
- i. none of them would pass; [7 Marks]
 - ii. only one of them would pass. [6 Marks]

5.

- a. Two dice are tossed together once.
- i. Construct a table to illustrate the possible outcomes of the experiment. [3 Marks]
 - ii. Use your table to find the probability that the numbers that show up
 - (α) are all even numbers, [3 Marks]
 - (β) have their sum greater than 7, [3 Marks]
 - (θ) have their sum to be exactly 6, [3 Marks]
 - (λ) are all odd numbers. [3 Marks]
- b. The probability that Akos passes the End of Semester Exams in Mathematics is $\frac{3}{7}$ and the probability that his friend Popo also passes the same paper is $\frac{2}{3}$. Calculate the probability that exactly one of them passes the Mathematics paper. [5 Marks]