2022 Mathematical Methods (Unit 1-2)
Task 4

Paper 1 – Calculator not allowed

Number of marks: 10
Writing time: 15 minutes

Name: Marks: Solutions.

Instructions

Answer **all** questions in the spaces provided.
In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

Kinza, Kadija, Heba and Afrah each have an equal chance of $\frac{2}{3}$ of visiting an art exhibition on any day.

a. What is the probability that Kinza and Kadija visit the art exhibition, but Afrah and Heba do not on a particular day? 1 mark

$$\left(\frac{2}{3}\right)^2 \times \left(\frac{1}{3}\right)^2 = \frac{4}{81}$$

b. What is the probability that more than one of the friends visit the art exhibition on a particular day? 2 marks

$$^4C_2\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^2 + {}^4C_3\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right) + {}^4C_0\left(\frac{2}{3}\right)^4$$

$$= \frac{8}{9}.$$

Question 2

The IT department of a local company is generating 4 digit passwords for login.

a. How many 4 digit passwords divisible by 5 can be formed using any of the numbers from 0 to 9 inclusive, such that none of the digits can be repeated. 1 mark

$9 \times 8 \times 7 \times 1 = 504$

$8 \times 8 \times 7 \times 1 = 448$

952 ways

b. What is the probability that a randomly selected password for an employer is a password generated in **part a** assuming none of the digits can be repeated? 2 marks

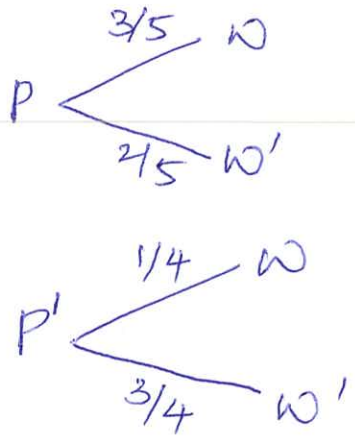
4 digit passwords: $9 \times 9 \times 8 \times 7 = 4536$

$\therefore \Pr(\text{even digit}) = \frac{952}{4536} = \frac{17}{81}$

Question 3

Lina decides to take her dog Loki for a walk, most mornings. If the weather is pleasant, the probability that she will walk Loki is $\frac{3}{5}$, and if the weather is unpleasant, the probability that she will walk Loki is $\frac{1}{4}$. Assume that pleasant weather on any morning is independent of pleasant weather on any other morning.

a. Display the above information on a tree diagram. 1 mark



b. In a particular week, the weather was pleasant on Monday morning and unpleasant on Tuesday morning. 1 mark

Find the probability that Lina walks Loki on at least one of these two mornings.

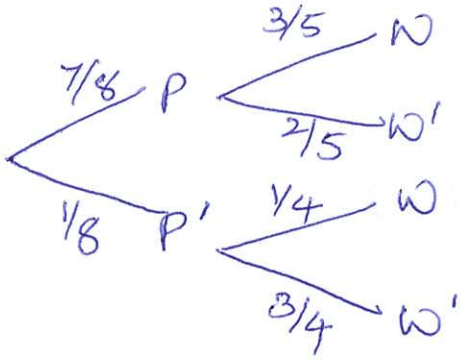
$1 - Pr(W'W') = 1 - \frac{2}{5} \times \frac{3}{4} = \frac{7}{10}$

OR

$\frac{3}{5} \times \frac{3}{4} + \frac{2}{5} \times \frac{1}{4} + \frac{3}{5} \times \frac{1}{4} = \frac{7}{10}$

b. In the month of April, the probability of pleasant weather is $\frac{7}{8}$. 2 marks

Find the probability that on a particular morning in April, Lina walked Loki.



OR

$PW + P'W$

$= \frac{7}{8} \times \frac{3}{5} + \frac{1}{8} \times \frac{1}{4} = \frac{89}{160}$.

Sirius College
"Reach for the stars"

2022 Mathematical Methods (Unit 1-2)
Task 4

Paper 2 – Calculator allowed

Number of marks: 15
Writing time: 25 minutes

Name: Marks – Section 1: Section 2:

SECTION 1

Instructions for Section 1

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

Events A and B are independent events from a sample space with $\Pr(A) = a$ and $\Pr(B) = b$.

$\Pr(A \cup B')$ is equal to:

A. $a+1-b$

B. $1+b-ab$

C. $1-b+ab$

D. $1-b-ab$

E. $b+1-a$

Question 2

A bag contains six red and four blue marbles. Three marbles are randomly drawn from the bag without replacement.

Given that at least two of the marbles drawn from the bag are red, the probability that all three marbles drawn from the bag are red is equal to

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. $\frac{2}{3}$

D. $\frac{1}{6}$

E. $\frac{1}{24}$

Question 3

If $P(X) = 0.1, \Pr(Y) = 0.4$, $\Pr(X \cup Y) = p$ also X and Y are mutually exclusive, then p equals:

A. 0.1

B. 0

C 0.05

D. 0.5

E. 0.04

Question 4

How many ways can the eleven-letters of the word 'MATHMETHODS' be arranged in a circle with the consonants together?

A. $\frac{8!4!}{2!2!2!}$

B. $\frac{8!3!}{2!2!2!}$

C. $\frac{10!}{2!2!2!2!}$

D. $\frac{8!3!}{2!2!2!2!}$

E. $10!2!2!$

Question 5

A six-sided die is tossed twice and the score observed each time.

The probability of obtaining a 3 from the first toss and an even number from the second is:

A $\frac{1}{12}$

B $\frac{1}{2}$

C $\frac{3}{4}$

D $\frac{2}{3}$

E $\frac{1}{6}$

SECTION 2

Instructions for Section 2

Answer **all** questions in the spaces provided.
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Question 1

Aisha randomly selects a dice and throws it. The two dice she selects from, are **an unbiased six-sided black dice** and **a biased six-sided red dice**. With the red dice, the probability of obtaining a six is $\frac{3}{8}$ and there is equal probability of obtaining a 1, 2, 3, 4 or 5.

a. What is the probability that Aisha throws a six? 2 marks

$$\frac{1}{2} \times \frac{1}{6} + \frac{1}{2} \times \frac{3}{8} = \frac{13}{48}$$

b. What is the probability that Aisha selected the black dice given that she threw a six? 2 marks

$$Pr(\text{Black} \mid \text{Six}) = \frac{\frac{1}{2} \times \frac{1}{6}}{\frac{13}{48}}$$

$$= \frac{4}{13}$$

Question 2

An art collector owns 15 paintings. The art gallery wishes to borrow some of these paintings as part of a display that shows the works of some great painters of that era.

a. If the art gallery borrows a set of three of these paintings, and they are displayed in a row on a wall of the art gallery, how many different arrangements are possible? 1 mark

$15P_3$ or $15 \times 14 \times 13 = 2730$ ways.

b. The art gallery decides to borrow four of the paintings and one of the four paintings is a classic. These paintings are going to be displayed in a row. How many different arrangements are possible? 2 marks

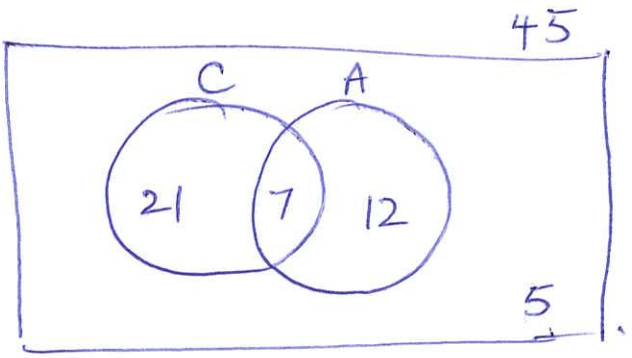
$14P_3 \times 4$ or $14C_3 \times 4!$

$= 8736$

Question 3

A survey was conducted on a group of 45 tourists visiting an art exhibition. 19 tourists like Abstract Art paintings and 28 tourists like Contemporary art paintings. Five of them like other art.

a. Represent the above information on a Venn diagram or Karnaught Table. 2 marks



b. What is the probability that a tourist from the above group likes Contemporary Art paintings only? 1 mark

$\frac{7}{15}$.