2021 Mathematical Methods (Unit 1-2)
Task 4

Paper 1 – Calculator not allowed

Number of marks: 10
Writing time: 15 minutes

Name: SOLUTIONS Marks:

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

Four-digit numbers are to be formed from the digits {2,3,4,5}.
Assume no repetition of digits in any number can occur.

a. How many four-digit odd numbers can be formed? 1 mark

$\underline{3}\ \underline{2}\ \underline{1}\ \underline{2}$ → 12 numbers
$\{3,5\}$

b. One of the four-digit odd number is chosen at random. What is the probability the number is greater than 3000 ? 2 marks

$\underline{2}\ \underline{2}\ \underline{1}\ \underline{2}$ → 8 numbers greater than 3000 (1 mark)
$\{3,4,5\}$ $\{3,5\}$

$\Pr(>3000 \mid \text{odd}) = \frac{8}{12} = \frac{2}{3}$ (1 mark for correct answer)

Question 2

Two events, A and B, from a given event space, are such that $\Pr(A) = \frac{2}{5}$ and $\Pr(B) = \frac{1}{6}$. 2 marks

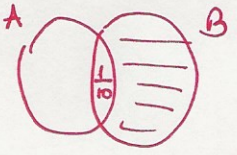
Calculate $\Pr(A' \cap B)$ when $\Pr(A \cap B) = \frac{1}{10}$.

$\Pr(A' \cap B) = \Pr(B) - \Pr(A \cap B)$ (1 mark)

$= \frac{1}{6} - \frac{1}{10}$

$= \frac{1}{15}$ (1 mark) $\frac{2}{30}$

OR



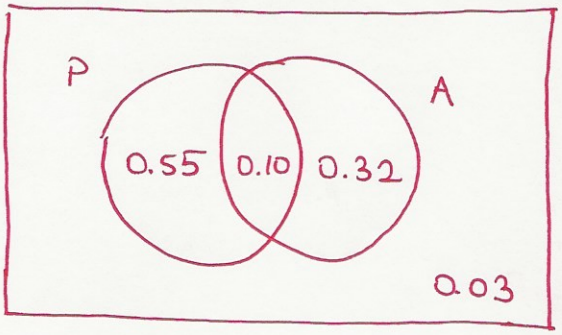
1 mark for identifying the correct region

$\frac{1}{6} - \frac{1}{10} = \frac{1}{15} = \frac{2}{30}$ 1 mark for correct answer

Question 3

According to a survey conducted in Australia,65% of the residents consented to receiving Pfizer Covid-19 vaccine and 42% consented to receiving AstraZeneca ,whereas 3% refused to both vaccine.

a. Draw a Venndiagram to illustrate the above information. 2 marks



any two correct numbers answers → 1 mark

all numbers are correct → 2 marks

b. Find the probability that a resident of Australia consented to Pfizer only. 1 mark

$$Pr(\text{Pfizer only}) = \frac{55}{100} = 0.55$$

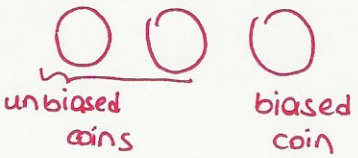
Question 4

2 marks

Adam has three coins in his pocket, two are unbiased and one is biased. When the biased coin is tossed,the probability of tossing a taii is $\frac{1}{5}$.

Adam selects a coin from his pocket and tosses it.

Find the probability that he tosses a tail.



$$Pr(B' \cap T) + Pr(B \cap T) = \frac{2}{3} \times \frac{1}{2} + \frac{1}{3} \times \frac{1}{5}$$

1 mark for finding any of these two prob.

$$= \frac{6}{15} = \frac{2}{5}$$

→ 1 mark for the correct answer

Sirius College

2021 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

If A and B are independent events such that $\Pr(A) = 0.28$ and $\Pr(B) = 0.65$, then $\Pr(A \cup B)$ is equal to:

A. 0.930
B. 0.854
C. 0.748
D. 0.692
E. 0.648

Question 2

A set of 4 white, 5 green and 6 blue mugs that are identical except for the colour are to be placed on a shelf. In how many ways can this be done if the same colour mugs are next to each other?

A. 6
B. 72
C. 23450
D. 630630
E. 2073600

Question 3

Two dice are rolled. The probability of getting a greater number on the first die than the one on the second, given that the sum equals to 8 is:

A. $\frac{1}{2}$

B. $\frac{5}{9}$

C. $\frac{7}{8}$

D. $\frac{1}{9}$

E. $\frac{2}{5}$

Question 4

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

A. $\frac{6!5!}{2!2!2!2!}$

B. $\frac{6!}{2!2!2!2!}$

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

D. $\frac{7!}{3!2!}$

E. $10!2!2!$

Question 5

A card is drawn randomly from a standard pack of 52 cards.

The probability that the card is a 7 or a diamond is closest to:

A. 0.308

B. 0.390

C. 0.410

D. 0.480

E. 0.510

SECTION 2

Instructions for Section 2

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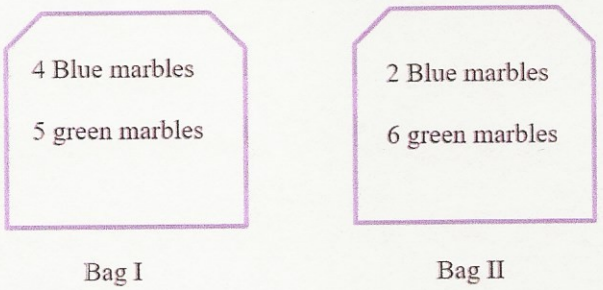
Question 1

A bag is chosen randomly and one marble is drawn randomly from it. Each bag is equally likely to be chosen.



a. What is the probability that the randomly drawn marble is blue? 2 marks

$Pr(Blue) = Pr(Bag_1\ Blue) + Pr(Bag_2\ Blue)$

$= \frac{1}{2}\frac{4}{9} + \frac{1}{2}\frac{2}{8}$

$Pr(Blue) = \frac{25}{72}$

1 mark for finding just one of the prob.
2 marks for full correct answer

b. Given that the marble is drawn is blue, what is the probability that it was drawn from Bag II? 2 marks

$Pr(Bag2/Blue) = \dfrac{\frac{1}{2}\frac{2}{8}}{\frac{25}{72}} = \frac{9}{25}$

1 mark 1 mark

c. A marble is drawn from Bag I and is put into Bag II then a marble is drawn from Bag II. 2 marks
What is the probability that the marble drawn from Bag II is green ?

$Pr(\underset{\uparrow}{Bag1}\ Blue\ \underset{\uparrow}{Bag2}\ Green) + Pr(\underset{\uparrow}{Bag1}\ Green\ \underset{\uparrow}{Bag2}\ Green) = \frac{4}{9}\frac{6}{9} + \frac{5}{9}\frac{7}{9} = \frac{59}{81}$

1 mark for finding either Pr(Blue Green) or Pr(Green Green)
1 mark for the correct answer

Question 2

Among a group of 13 books on a shelf, 7 are hardbacks and 6 are paperbacks.

a. In how many ways can any set of 8 books be selected from this group of books? 1 mark

$^{13}C_8 = 1287$

b. In how many ways can 4 hardbacks and 2 paperbacks be chosen from this group of books? 1 mark

$^{7}C_4 \times {}^{6}C_2 = 525$

c. Five books will be chosen from this group. What is the probability of selecting two hardbacks and three paperbacks? 2 marks

$$Pr(2H\,3P) = \frac{{}^{7}C_2 \times {}^{6}C_3}{{}^{13}C_5}$$

1 mark for the equation

$Pr(2H\,3P) = 0.326$

1 mark for the correct answer