MATH 323 - ASSIGNMENT 1

Due: 11.59 pm on Friday 24th September – please enter numerical answers into the Assignment 1 Quiz in myCourses.



The following Venn diagram depicts the partition of sample space *S* created by two events *A* and *B*.

- 1. For each of parts (a) to (e), using the information given in the question, find the numerical value of probability requested. If there is insufficient information to find the requested probability, or the information in the question is invalid or contradictory, report the value NA.
 - (a) Find P(A) if

$$P(A \cap B') = 0.37$$
 $P(A' \cap B) = 0.09$ $P(A' \cap B') = 0.22$

2 MARKS

(c) Find
$$P(A \cup B)$$
 if
 $P(A) = 0.52$ $P(A \cap B') = 0.24$

$$P(A) = 0.80$$
 $P(B) = 0.25$ $P(A' \cap B') = 0.04$

2 MARKS

2 MARKS

(d) Find the probability of the event

$$(A \cap B') \cup (A' \cap B)$$
$$P(A \cap B) = 0.20 \qquad P(A' \cap B') = 0.28$$

2 MARKS

P(A) = 0.78 P(B) = 0.31 $P(A \cup B) = 0.86.$

2 MARKS

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(e) Find $P(A \cap B)$ if

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(b) Find $P(A \cap B)$ if

if

2. In 2018, a survey of 1000 high-school students was carried out to establish the amount of usage of three social media platforms. Each student was asked whether they were regular users of

A – WhatsApp B – Instagram C – TikTok

The survey results are reported in the following table:

Α	В	С	Count
Y	Y	Y	262
Y	Y	Ν	230
Y	Ν	Y	139
N	Y	Y	139
Y	Ν	Ν	96
N	Y	Ν	70
N	Ν	Y	55
N	Ν	Ν	9

For example, 230 participants reported being regular users of WhatsApp and Instagram but not TikTok.

One participant is selected for follow-up, with all participants being equally likely to be selected. Denoting by *A*, *B* and *C* the events that the selected participant reports using platform A, B and C respectively, compute

(a) $P(A)$	2 MARKS

(b)
$$P(A \cup B \cup C)$$
 2 MARKS

(c)
$$P((A \cap B \cap C') \cup (A \cap B' \cap C) \cup (A' \cap B \cap C))$$
 2 MARKS

Report your answers to three decimal places.

3. A game of dice is played by repeatedly rolling a fair die (where outcomes $\{1, 2, 3, 4, 5, 6\}$ are equally likely on each roll, and the result of any roll does not affect the result of any other roll) until the number 1 or the number 6 is rolled. What is the probability that the game ends on an odd-numbered of roll?

Hint: here the sample space *S* is the collection of sample outcomes each of which describes when the game ends; for $i \ge 1$, define the elementary event E_i to be "the game ends on roll *i*". Let the event *A* be the event "the game ends on an odd-numbered of roll". Then we have the (countable) partitions

$$S = \bigcup_{i=1}^{\infty} E_i$$
 and $A = \bigcup_{i=0}^{\infty} E_{2i+1}$

We need to find P(A).

Suppose the game ends on roll five; we must have had four consecutive rolls with results that are NOT 1 or 6, and then one roll where the result IS 1 or 6. By the conditions of the experiment, all sequences of five rolls are equally likely and there are 6^5 possible such sequences (we can get any of the results $\{1, 2, 3, 4, 5, 6\}$ on each of the five rolls); of these sequences, only a subset meet the condition that the first four rolls do not give 1 or 6, but the last one does give 1 or 6. To compute the probability of the game ending on roll five, you need to count the number of sequences in the subset.