

ENGI 4421
Term Test 1
2021 June 10

1. The numbers x of projects (out of 5) completed without errors for each of 200 contractors are as shown in this frequency table:

x	f			
0	8			
1	20			
2	30			
3	40			
4	50			
5	52			
Total	200			

- In parts (a), (b) and (c), use this frequency table (and show your working) to find
- (a) the sample median number \tilde{x} of projects completed without errors [4]
 - (b) the sample mean number \bar{x} of projects completed without errors [4]
 - (c) the sample standard deviation s [you may leave your answer *either* as a decimal rounded off to three decimal places *or* as an exact value inside a square root.] [6]
 - (d) Does this data set show positive skew, negative skew or no skew? [2]
State *one* reason for your conclusion.
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2. Given the information for the three events A, B, C

$$P[A] = .75, \quad P[B] = .40, \quad P[C] = .35, \quad P[A \cap B] = .30, \\ P[B \cap C] = .15, \quad P[C \cap A] = .25, \quad P[A \cap B \cap C] = .10$$

- (a) Are events A, B independent? [2]
 - (b) Are events A, B, C independent? [2]
 - (c) Find the probability that at least one of the events A, B, C occurs. [5]
 - (d) Find the probability that exactly one of the events A, B, C occurs. [8]
 - (e) Find the *exact* value of $P[B|C]$ [4]
 - (f) Does knowledge that event C has occurred increase, decrease or not change the probability that event B occurs? [2]
 - (g) Convert your answer to part (e) into odds. [3]
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3. A company has put out a tender call for three projects. [8]
Twelve contractors have each placed bids on all three projects.
A contractor cannot be awarded more than one project.
If all three projects are awarded, in how many distinct ways can they be allocated among the contractors?

Show your working and express your final answer as a single number.

4. *BONUS QUESTION* [+5]

Events A, B, C form a partition. A book-keeper has received 80 deposits, each for \$25. 50 deposits will win a reward if event A occurs, 22 deposits if event B occurs and 8 deposits if event C occurs. The book-keeper quotes odds for each event, whose associated “probabilities” p_i are directly proportional to the number of deposits received for that event i . p_i is also the ratio of deposit to reward for event i .

What must the total $\sum_i p_i = p_A + p_B + p_C$ be, in order to guarantee a profit of at least \$500 for the book-keeper?

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