ENGI 4421

Term Test 1

2019 June 13

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1. Ten observations of completion times t (in minutes) for a testing procedure are listed here, in ascending order.

$$13 \;\; 42 \;\; 46 \;\; 51 \;\; 54 \;\; 58 \;\; 59 \;\; 61 \;\; 65 \;\; 70$$

(a) Find the upper quartile Q_3 and show your calculations. [4]

(b) Determine whether the minimum observation (13 min) is an extreme outlier, a mild outlier, or not an outlier at all. [6]
You may quote the value of the lower quartile $Q_1 = 45$ min.

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2. Given the following information for events A, B, C

$$\mathrm{P}[A] = .35, \quad \mathrm{P}[B] = .30, \quad \mathrm{P}[C] = .40,$$
$$\mathrm{P}[A \cap B] = .20, \quad \mathrm{P}[B \cap C] = .12, \quad \mathrm{P}[C \cap A] = .15,$$
$$\mathrm{P}[A \cap B \cap C] = .042$$

(a) Are events B, C independent? Why or why not? [2]

(b) Are events A, B, C independent? Why or why not? [3]

(c) Find the probability that *none* of events A, B, C occur. [4]

(d) Find the **odds** that event A occurs, given that event C does *not* occur. [6]

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3. A discrete random quantity X has a probability mass function defined by

$$p(x) = k(x-1)^2 \quad (x = 2, 3, 4)$$

(a) Show that $k = \frac{1}{14}$ in order for $p(x)$ to be a valid probability mass function. [3]

(b) Find the mode. [2]

(c) Find the cumulative distribution function $F(x) = \mathrm{P}[X \le x]$ [3]

(d) Find $\mathrm{E}[X]$ (as a fraction in its lowest terms). [3]

(e) Find $\mathrm{V}[X]$ (as a fraction in its lowest terms). [4]

BONUS QUESTION

4. Prove that events $\tilde{A}$, $\tilde{B}$ are independent if and only if events A, B are independent. [+4]

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