Statistics 251: Lab 2

Handout

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Students should write the name they are registered with. Do not put nicknames/short forms on the handout. Please write down your answers neatly and do show your work.

1. Let X_1 be the speed of the first skytrain, X_2 be the speed of the second skytrain, and X_3 be the speed of the third skytrain. Please remember to use proper notation in your solutions.

a.

$$X_1 = 0.3, X_2 = 0.3, X_3 = 0.3$$

The probability that $X_1 = X_2 = X_3 = 40\frac{km}{hr}$ is $0.3 * 0.3 * 0.3 = 0.3^3 = 0.027$

Or 2.7%

b.

$$P(X \leq x) = \sum f(x)$$

$$f(60) + f(50) + f(40) = 0.4 + 0.3 + 0.2 = 0.9$$

So the chances 1 sky train goes <=60 is 90%, and since they are independent, the chances that all 3 did this is:

$$0.9 * 0.9 * 0.9 = 0.9^3 = 0.729$$

c.

The probability that no train went more than 80 is:

$$(1 - 0.1)^3 = 0.729$$

So the probability that at the very least 1 train went more than 80 km/hr is

$$1 - 0.729 = 0.271 = 27.1\%$$

d.

$$P(X_1 \& X_2) = 0.1 * 0.1 * 0.9 = 0.009$$

$$P(X_1 \& X_3) = 0.1 * 0.9 * 0.1 = 0.009$$

$$P(X_2 \& X_3) = 0.9 * 0.1 * 0.1 = 0.009$$

$$P(X_1 \& X_2 \& X_3) = 0.1^3 = 0.001$$

The sum of all these probabilities is 0.028 or 2.8%

2. Let A_1 be the event that skytrain 1 breaks down, A_2 be the event that skytrain 2 breaks down, and A_3 be the event that skytrain 3 breaks down. Please remember to use proper notation in your solutions.
   a. [hint: consider dividing the chain into 2 parts]

$$A_1 = 0.1, \qquad A_2 \cap A_3 = 0.1^2 = 0.01$$

$$R_1 = 1 - A_1 = 0.9$$

$$R_{2\&3} = 1 - 0.01 = 0.99$$

$$R = R_1 * R_{2\&3} = 0.9 * 0.99 = 0.891$$

b.

$$P(A) = 1 - 0.891 = 0.109$$

$$P(A_1|A) = \frac{P(A_1 \cap A)}{P(A)} = \frac{0.1}{0.109} = 0.9174 = 91.74\%$$

c.

Since train 3 can work 100% of the time, it does not matter if train 2 breaks down! The only thing that would make the system fail is if train 1 broke, therefore:

$$R = 1 - A_1 = 1 - 0.1 = 0.9$$

90% reliability