STAT 254 – Test 1

February 11, 2019 **Name:** Solution Set

Instructor: Patricia Wrean

Total: 25 points

1. (3 points) A statistician working for BC Ferries wants to study the time it takes to complete the ferry sailing from Vancouver to Victoria. To do so, she randomly selects fifty ferry sailings on the route from Vancouver to Victoria within the last year and records the time it took the ferry to complete the trip.

   (a) The population is

   (i) the time for one ferry sailing on that route during that year
   (ii) the times for the fifty ferry sailings selected on that route during that year
   (iii) the times for all ferry sailings on that route during that year
   (iv) the times for all ferry sailings on that route
   (v) the times for all ferry sailings in BC

   -½ → (iii)
   (iv) ✓
   -1 all others

   (b) Name a variable being measured. time

   (c) For your answer to part (b), this variable is, in theory,

   (i) qualitative -1
   (ii) quantitative and discrete -½
   (iii) ✓ quantitative and continuous

2. (3 points) Suppose that $P(A) = 0.3$, $P(B) = 0.4$, and $P(A|B) = 0.4$.

   (a) Are A and B independent? Explain briefly.

   no, because $P(A) \neq P(A|B)$

   (b) Calculate $P(A \text{ or } B)$.

$$\begin{aligned} P(A \text{ or } B) &= P(A) + P(B) - P(AB) \\ &= P(A) + P(B) - P(A|B)P(B) \\ &= 0.3 + 0.4 - (0.4)(0.4) \\ &= 0.54 \end{aligned}$$

3. (3 points) Because of inflation, the Camosun Bookstore will be raising the prices of all of its textbooks in the fall. Each textbook has a different price and you may assume that there are many textbooks for sale.

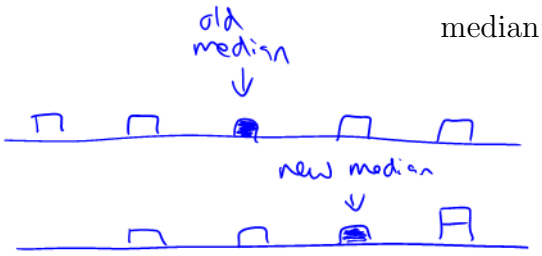
   (a) If every textbook has its price increased by fifteen dollars, what happens to the following quantities? Be as specific as you can!

   mean: increase by $15

   standard deviation: stay same

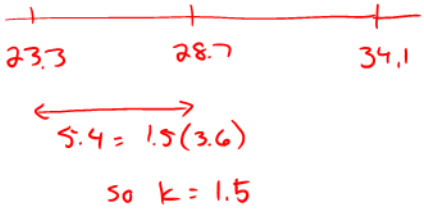
   (b) Only one textbook needs to have its price changed: the cheapest textbook will have its price increased to be the same as the most expensive textbook. All other items keep their current prices. Does the median price increase, decrease, or stay the same?

   median: increases



4. (2 points) The time it takes to drive from the Lansdowne campus to the Interurban campus during the day has a mean of 28.7 minutes and a standard deviation of 3.6 minutes. If you were to make this drive repeatedly, what can you say about the number of trips that would take

   (a) between 23.3 and 34.1 minutes?



Tchebysheff:

$\geq \left(1 - \frac{1}{k^2}\right)$

$\geq \left(1 - \frac{1}{1.5^2}\right)$

$\geq 0.\overline{5}$ so $\geq$ 56%

   (b) above 34.1 minutes?

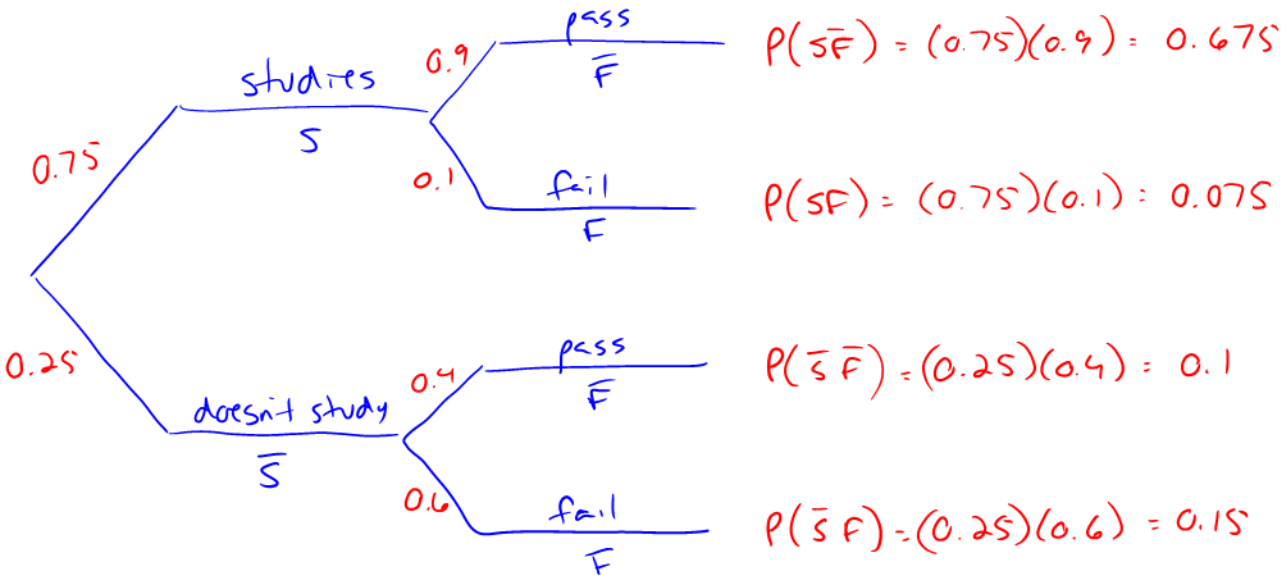
can't assume symmetry

so $\leq$ 44% (rest of the points)

(-1/2) if no $\geq$, $\leq$

(-1/2) if assumed symmetry

5. (4 points) A student in Pat's precalculus class studies for tests 75% of the time. If he studies, the probability of his passing is 90%. However, if he doesn't study, he'll pass only 40% of the time.
   (a) On the next test, what's the probability that this student will pass?
   (b) If the student fails, what's the probability that he didn't study?



$P(S\bar{F}) = (0.75)(0.9) = 0.675$

$P(SF) = (0.75)(0.1) = 0.075$

$P(\bar{S}\bar{F}) = (0.25)(0.4) = 0.1$

$P(\bar{S}F) = (0.25)(0.6) = 0.15$

a) $P(\bar{F}) = P(S\bar{F}) + P(\bar{S}\bar{F}) = 0.675 + 0.1 = 0.775$ → 77.5%

b) $P(\bar{S} \mid F) = \dfrac{P(\bar{S}F)}{P(F)} = \dfrac{0.15}{0.15 + 0.075} = \dfrac{2}{3} = 66.\overline{6}\%$

↑ or could say $1 - 0.775$

6. (2 points) Consider a typical episode of the Mythbusters TV series. Of the five Mythbusters, three of them have also worked on the special effects of Star Wars.

   If you picked two of the five Mythbusters at random, what probability distribution best describes x, the number of Mythbusters chosen who have also worked on Star Wars? Explain briefly.

hypergeometric, because you are choosing without replacement

7. (4 points) On her maiden voyage, the ship Titanic hit an iceberg and sank. She was carrying 1339 passengers and 884 crewmembers, for a total of 2223 people on board. 482 passengers and 221 crewmembers survived the sinking.

   Are "being a crewmember" and "surviving" independent? Explain your reasoning, including values of appropriate probabilities.

	crew C	pass $\bar{C}$	
survived S	221	482	703
didn't $\bar{S}$	663	857	1520
	884	1339	2223

method #1:

$P(C) = \frac{n(C)}{n_{tot}} = \frac{884}{2223} = 0.397661$ or 39.8%

$P(C|S) = \frac{n(CS)}{n(S)} = \frac{221}{703} = 0.314367$ or 31.4%

not equal ∴ dependent

method # 2:

$P(S) = \frac{n(S)}{n_{tot}} = \frac{703}{2223} = 0.316231$ or 31.6%

$P(S|C) = \frac{n(SC)}{n_{tot}} = \frac{221}{884} = 25\%$

not equal ∴ dependent

method #3: $P(CS) = \frac{n(CS)}{n_{tot}} = \frac{221}{2223} = 0.099$

$P(C) \cdot P(S) = (0.397661)(0.316231) = 0.125$

since $P(CS) \neq P(C) \cdot P(S)$, dependent

8. (4 points) Suppose that the day of the week on which a person is born is evenly distributed throughout the week. What is the probability that of any seven people, exactly one was born on a Monday? At least one?

binomial with $n = 7$, $p = 1/7$

$$P(x = k) = {}_nC_k \, p^k q^{n-k}$$

a) $P(x = 1) = {}_7C_1 \left(\frac{1}{7}\right)^1 \left(\frac{6}{7}\right)^6 = \frac{46656}{117649} \approx 0.396569$

$\approx 40\%$

b) $P(x \geq 1) = 1 - P(x = 0)$

$= 1 - {}_7C_0 \left(\frac{1}{7}\right)^0 \left(\frac{6}{7}\right)^7$

$= \frac{543607}{623543} \approx 0.660083$

$\approx 66\%$