

Name _____

Date _____

1. In a history class 57% of the students eat breakfast in the morning and 80% of the students floss their teeth. 46% of the students eat breakfast and also floss their teeth.

a) What is the probability that a student from this class eats breakfast but does not floss their teeth?

$$0.57 - 0.46 = 0.11$$

b) What is the probability that a student from this class eats breakfast or flosses their teeth?

$$(1) P(E) + P(F) - P(E \cap F) = 0.57 + 0.80 - 0.46 = 0.91$$

or

$$(2) \text{ From Venn diagram } P(E \cup F) = 0.11 + 0.46 + 0.34 = 0.91$$

2) Five juniors and four seniors have applied for two open student council positions. School administrators have decided to pick the two new members randomly. What is the probability that they are both juniors or both seniors?

$$\begin{array}{l} \frac{5}{9} \text{ J} \begin{cases} \frac{4}{8} \text{ J} \Rightarrow P(J \cap J) = \left(\frac{5}{9}\right)\left(\frac{4}{8}\right) = \frac{20}{72} = \frac{5}{18} \star \\ \frac{4}{8} \text{ S} \Rightarrow P(J \cap S) = \left(\frac{5}{9}\right)\left(\frac{4}{8}\right) = \frac{20}{72} = \frac{5}{18} \end{cases} \\ \frac{4}{9} \text{ S} \begin{cases} \frac{5}{8} \text{ J} \Rightarrow P(S \cap J) = \left(\frac{4}{9}\right)\left(\frac{5}{8}\right) = \frac{20}{72} = \frac{5}{18} \\ \frac{3}{8} \text{ S} \Rightarrow P(S \cap S) = \left(\frac{4}{9}\right)\left(\frac{3}{8}\right) = \frac{12}{72} = \frac{1}{6} \star \end{cases} \end{array}$$

$$P((S \cap S) \cup (J \cap J)) = P(J \cap J) + P(S \cap S) = \frac{5}{18} + \frac{1}{6} = \frac{4}{9} = 0.\overline{44} \approx 0.44$$

3) Some marathons allow two runners to "split" the marathon by each running a half marathon. Mr. Whipple and Mr. Raymond plan to split a marathon. Mr. Whipple's half-marathon times average 92 minutes with a standard deviation of 4 minutes. Mr. Raymond's times average 96 minutes with a standard deviation of 2 minutes. What is the expected time for Mr. Whipple and Mr. Raymond to complete a full marathon. What is the standard deviation of their total time?

Variables
 W = Whipple's time
 R = Raymond's time

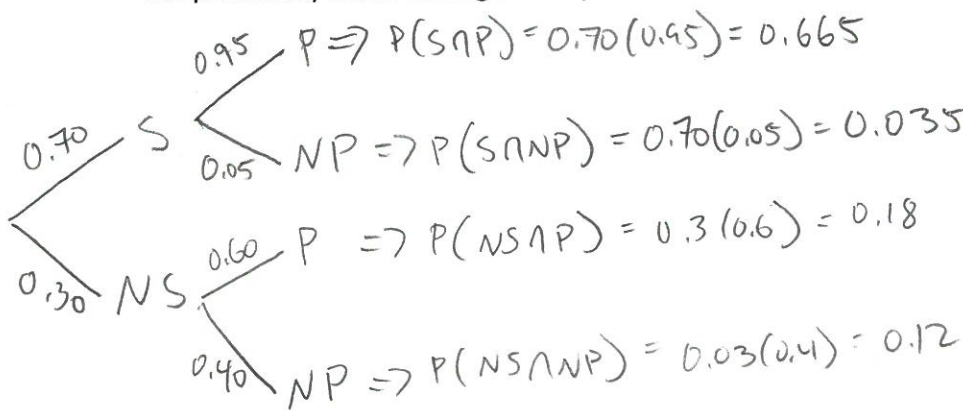
$$E(W+R) = E(W) + E(R) \quad SD(W+R) = \sqrt{SD(W)^2 + SD(R)^2}$$

$$= 92 + 96 \quad = \sqrt{4^2 + 2^2}$$

$$\rightarrow = \boxed{188 \text{ min}} \quad = \sqrt{16 + 4}$$

$$\rightarrow = \sqrt{20} = \boxed{2\sqrt{5} \approx 4.47}$$

4) Assume that 70% of teenagers who go to take the written drivers license test have studied for the test. Of those who study for the test, 95% pass; of those who do not study for the test 60% pass. What is the probability that a teenager who passes the written drivers license test did not study for the test?



$$P(NS|P) = \frac{P(NS \cap P)}{P(P)}$$

$$= \frac{0.18}{0.665 + 0.18}$$

$$= \frac{0.18}{0.845}$$

$$= \frac{36}{169} \approx 0.21 \approx 21\%$$

5) According to the National Health Survey, heights of adults may have a normal model with mean heights of 69.1 inches for men and 64.0 inches for women. The standard deviation for men is 2.5 inches and for women it is 2.1 inches. What is the standard deviation for the difference in men's and women's heights?

Variables
 M = mens height
 W = womens height

$$SD(M-W) = \sqrt{SD(M)^2 + SD(W)^2}$$

$$= \sqrt{2.5^2 + 2.1^2}$$

$$= \sqrt{6.25 + 4.41}$$

$$= \sqrt{10.66}$$

$$\approx \boxed{3.26}$$

6) An insurance policy costs \$100 and will pay policyholders \$10,000 if they suffer a major injury (resulting in hospitalization) or \$3,000 if they suffer a minor injury (resulting in lost time from work). The company estimates that each year 1 in every 2000 policy holders may have a major injury, and 1 in 500 a minor injury only.

- Create probability model for the profit on a policy
- What's the company's expected profit on this policy?
- What's the standard deviation?

a)

Outcome	X	P(X)
major injury	$100 - 10000 = -9900$	$\frac{1}{2000}$
minor injury	$100 - 3000 = -2900$	$\frac{1}{500}$
no injury	100	$1 - (\frac{1}{2000} + \frac{1}{500}) = \frac{399}{400}$

b) $E(X) = -9900\left(\frac{1}{2000}\right) + -2900\left(\frac{1}{500}\right) + 100\left(\frac{399}{400}\right)$

$= \boxed{\$89}$

c) $SD(X) = \sqrt{(-9900 - 89)^2\left(\frac{1}{2000}\right) + (-2900 - 89)^2\left(\frac{1}{500}\right) + (100 - 89)^2\left(\frac{399}{400}\right)}$

$= \boxed{\$718.95}$ (rounded to 2 dec. place)

7) A slot machine has three wheels that spin independently. Each has 10 equally likely symbols: 4 bars, 3 lemons, 2 cherries, and a bell. If you play, what is the probability that

- you get 3 lemons?
- you get no fruit symbols?
- you get 3 bells (the jackpot)?
- you get not bells?
- you get at least one bar (an automatic loser)?

a) $\left(\frac{3}{10}\right)^3 = \frac{27}{1000} = 0.027$

b) $\left(\frac{5}{10}\right)^3 = \frac{125}{1000} = \frac{1}{8}$

c) $\left(\frac{1}{10}\right)^3 = \frac{1}{1000} = 0.001$

d) $\left(\frac{9}{10}\right)^3 = \frac{729}{1000} = 0.729$

e) 1 - no bar

$1 - \left(\frac{6}{10}\right)^3$

$1 - \frac{216}{1000}$

$1 - \frac{27}{125}$

$\frac{98}{125} = 0.784$

