Math 110 Supplemental Instruction Worksheet 4

1. In a particular town, 27% of the male population has a mustache. Of those men with a mustache, 65% also have a beard and of those men without a mustache, 31% have a beard.

   (a) Draw a tree representing the information given. Be sure to label all the branches.

   $$.27 \text{ mustache} \begin{cases} .65 \text{ beard} \\ .35 \text{ no beard} \end{cases}$$
   $$.73 \text{ no mustache} \begin{cases} .31 \text{ beard} \\ .69 \text{ no beard} \end{cases}$$
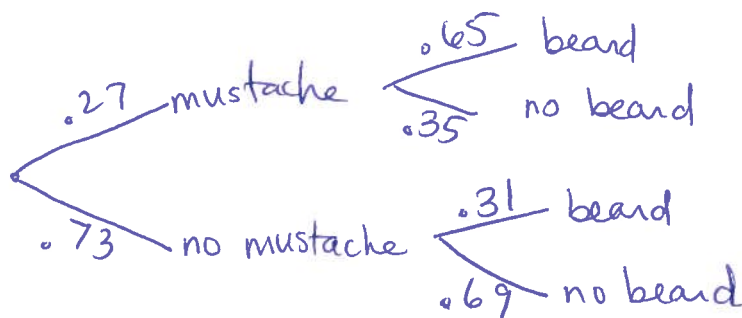
   (b) Calculate the probability that a man has both a beard and a mustache.

   $$P(\text{beard and mustache}) = .27 \cdot .65 = .1755$$

   (c) Calculate the probability that a man has a beard.

   $$P(\text{beard}) = .27 \cdot .65 + .73 \cdot .31 = .1755 + .2263$$
   $$= .4018$$

   (d) Using the formula for conditional probability, calculate the probability that a man has mustache given that he has a beard.

   $$P(\text{mustache} \mid \text{beard}) = \frac{P(\text{beard and mustache})}{P(\text{beard})} = \frac{.1755}{.4018}$$
   $$= .437$$

   (e) Are the events "has a mustache" and "has a beard" independent? Justify your answer (using math!).

   $$P(\text{beard and mustache}) = .1755$$
   $$P(\text{beard}) \cdot P(\text{mustache}) = .4018 \cdot .27 = .1085$$

   Since $P(b \& m) \neq P(b) \cdot P(m)$, these events are not independent

2. In a recent poll, 28% of male respondents identified as Republican, 32% as Democrat and ~~40~~ as 40% (handwritten correction above: 40%)
Independent. Among female respondents, 25% identified as Republican, 41% as Democrat and ~~25~~% as
Independent. Suppose 52% of the voting-age population are women. 34 (handwritten)

(a) Draw a tree representing the information given. Be sure to label all the branches.
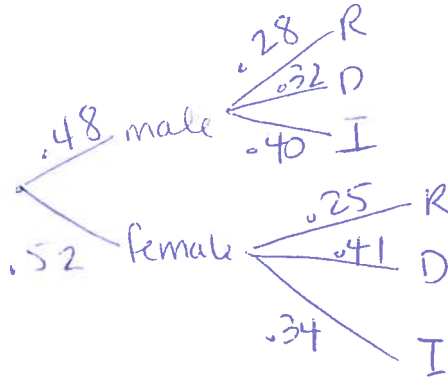
(b) What is the probability a randomly selected person is a male republican?

$$P(\text{male \& Rep}) = .48 \cdot .28 = .1344$$

(c) What is the probability a randomly selected person is a female Independent?

$$P(\text{female \& Ind}) = .52 \cdot .34 = .1768$$

(d) What is the probability a randomly selected person is an Independent?

$$P(\text{Ind}) = .48 \cdot .40 + .52 \cdot .34$$
$$= .192 + .1768 = .3688$$

(e) Are the events "female respondent" and "Independent" independent events? Justify your answer.

$$P(\text{female and ind}) = .1768$$
$$P(\text{female}) \cdot P(\text{ind}) = .3688 \cdot .52 = .1918$$

Since $P(f \text{ and } \text{ind}) \neq P(f) \cdot P(\text{ind})$, these events are not independent