Print **all** group member's names here. Circle the name of the group member who turns this in.

SOLUTIONS

For questions 1-3, refer to the Fourth Probability Worksheet to find verbal descriptions of each of the medical probability terms.

1. A group of scientists is developing a screening test to detect a disease. In a trial with 300 participants, we know that 80 of them have the disease. The scientists report their test had a false positive rate of 2.27% and a false negative rate of 10%. Recreate the data from the trial. When needed, round to the nearest whole number.

	Positive test	Negative test	*total*
Have the disease	72	$y = 8$	80
Do not have the disease	$x = 5$	215	220
total	77	223	300

False neg rate: $P(\text{neg test} \mid \text{have disease}) = \frac{y}{80} = \frac{10}{100}$

$\Rightarrow y = \frac{10}{100} \cdot 80 = 8$

False positive rate: $P(\text{test pos} \mid \text{don't have disease}) = \frac{x}{220} = \frac{2.27}{100} \Rightarrow x = \frac{2.27}{100} \cdot 220 = 4.994 \rightsquigarrow 5$

2. Use the filled-in table above to find the following. **Express each of these as a conditional probability**, and give the answer as a fraction (no need to reduce):

   (a) the **sensitivity** $P(\text{test pos} \mid \text{have disease}) = \frac{72}{80}$

   (b) The **specificity** $P(\text{test neg} \mid \text{don't have disease}) = \frac{215}{220}$

   (c) The **PPV** (positive predictive value): $P(\text{have disease} \mid \text{test pos}) = \frac{72}{77}$

   (d) The **NPV** (Negative predictive value): $P(\text{don't have disease} \mid \text{test neg}) = \frac{215}{223}$

3. Are the events "the test was positive" and "the patient has the disease" independent or dependent? Show correct computations and notation to justify.

$P(\text{test pos}) = \frac{77}{300}$ $P(\text{test pos} \mid \text{has disease}) = \frac{72}{80}$

The probability of a positive test changes (is much higher) if we know in advance they have the disease. These events are dependent.

Math 111 Fifth Probability Worksheet *the back*

Continuous Probability

SOLUTIONS

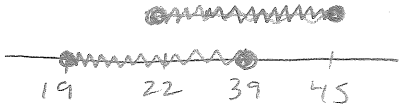
length $89-14=75$

For question 4, we are choosing a number at random from the interval $[14,89]$. Assume every real number in the interval is equally likely to be chosen. For each problem below, draw the appropriate number line, simplify the interval if possible, and give the probability as a fraction (no need to reduce).

4. What is the probability we select a number in the following intervals?

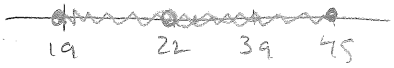
a. $[19,39]$ $P([19,39]) = \frac{39-19}{75} = \boxed{\frac{20}{75}}$

b. $[19,39]\cap[22,45]$



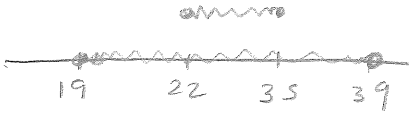
Simplifies to $[22,39]$ $P = \frac{39-22}{75} = \boxed{\frac{17}{75}}$

c. $[19,39]\cup[22,45]$



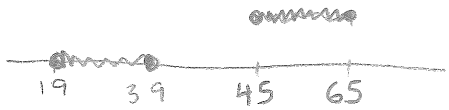
simplifies to $[19,45]$ $P = \frac{45-19}{75} = \boxed{\frac{26}{75}}$

d. $[19,39]\cap[22,35]$



simplifies to $[22,35]$ $P = \frac{35-22}{75} = \boxed{\frac{13}{75}}$

e. $[19,39]\cap[45,65]$

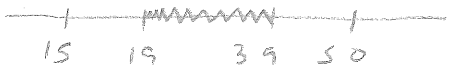


simplifies to the empty set $\emptyset$ or $\{\}$ $P = \frac{0}{75} = \boxed{0}$

f. $[19,39]\cup[45,65]$

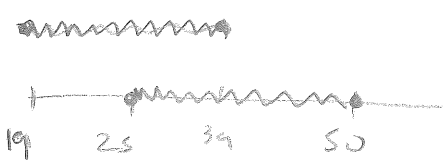
already simplified $P = \frac{(39-19)+(65-45)}{75} = \frac{20+20}{75} = \boxed{\frac{40}{75}}$

g. $[19,39]$, given that it is in $[15,50]$



$P = \frac{39-19}{50-15} = \boxed{\frac{20}{35}}$

h. $[19,39]$, given that it is in $[25,50]$



intersection is $[25,39]$ $P = \frac{39-25}{50-25} = \boxed{\frac{14}{25}}$