Math 480 Quiz 2 fall 2018 Name____________________

1) The table below shows college students by gender and age in 2003 (in thousands of people).

gender / age	15-17	18-24	25-34	35 or older	total
female (F)	89	5668	1904	1660	9321
male (M)	61	4697	1589	970	7317
total	150	10365	3493	2630	16638

a) What is the probability that a college student is female?

$P(F) = \frac{9321}{16638} = \boxed{0.5602}$

b) What is the probability that a college student is female given that the student is 18-24?

$P(F|18\text{-}24) = \frac{P(F \cap 18\text{-}24)}{P(18\text{-}24)} = \frac{5668/16638}{10365/16638} = \frac{5668}{10365} = \boxed{0.5468}$

c) Are the events F and 18-24 independent? Explain.

-5 if ind

$\boxed{\text{no}}$, $.5602 = P(F) \neq P(F|18\text{-}24) = .5468$

or $P(F \cap 18\text{-}24) = \frac{5668}{16638} = .3407 \neq P(F)P(18\text{-}24) = .5602 \cdot \underbrace{\frac{10365}{16638}}_{.6230} = .3490$

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2) Suppose P(A) = 0.4 and P(B) = 0.5.

a) Find P(A ∪ B) if events A and B are independent.

$P(A) + P(B) - P(A)P(B) = .4 + .5 - \underbrace{.4(.5)}_{.2} = \boxed{0.7}$

so $P(A \cup B) = 1 - P(\bar{A}\bar{B})$

b) Find P(A ∪ B) if events A and B are disjoint (mutually exclusive).

$P(A) + P(B) = .4 + .5 = \boxed{0.9}$

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3) Suppose that $P(A) = 0.4$, $P(B) = 0.5$ and $P(A \cup B) = 0.8$. Find $P(A \cap B)$.

$= P(A) - P(B) - P(A \cup B)$

$= .4 + .5 - .8 = \boxed{0.1}$

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4) Suppose that only one in 1000 adults is afflicted with a rare disease for which a diagnostic test has been developed. If the individual actually has the disease, a positive test result will occur 99% of the time. If the individual does not have the disease, a positive result will occur only 2% of the time. Let $A_1 =$ "individual has the disease." Let $E =$ "the test result is positive."

a) Find the probability that a randomly selected individual does not have the disease.

$$P(\bar{A}_1) = 1 - \frac{1}{1000} = \boxed{\frac{999}{1000} = 0.999}$$

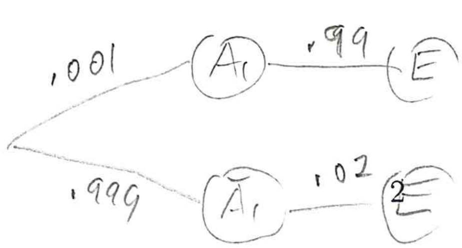
b) Find the probability that the test is positive given that the individual does not have the disease.

$$P(E/\bar{A}_1) = 2\% = \boxed{0.02}$$

c Find the probability that the individual has the disease given that the test result is positive. (Hint: use Bayes' formula.)

$$P(A_1|E) = \frac{P(A_1)\,P(E|A_1)}{P(A_1)\,P(E|A_1) + P(\bar{A}_1)\,P(E|\bar{A}_1)} = \frac{(.001)(.99)}{(.001).99 + .999(.02)}$$

$$= \frac{.00099}{.02097} = \boxed{0.04721}$$



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$P(E \cap \bar{A}_1) = P(E/\bar{A}_1)\,P(\bar{A}_1) = .999(.02)$