AP Statistics
Name Key

Mixed Probability Problems

1. Let A denote the event `student is female' and let B denote the event `student is French'. In a class of 100 students suppose 60 are French, and suppose that 10 of the French students are females. Find the probability that if I pick a French student, it will be a girl.

$$P(\text{Girl}|\text{French}) = \frac{P(\text{Girl and French})}{P(\text{French})} = \frac{10/100}{60/100} = 1/6$$

2. If the probability that person A will be alive in 20 years is 0.7 and the probability that person B will be alive in 20 years is 0.5, what is the probability that they will both be alive in 20 years?

$$(0.7)(0.5) = 0.35$$

3. What is the probability that the total of two dice will be greater than 8, given that the first die is a 6?

$$P(\text{total} > 8 \mid 1^{\text{st}} \text{ is } 6) = \frac{P(\text{sum} > 8 \text{ and } 1^{\text{st}} \text{ is } 6)}{P(1^{\text{st}} \text{ is } 6)} = \frac{4/36}{1/6} = 2/3$$

4. A fair die is tossed twice. Find the probability of getting a 4 or 5 on the first toss and a 1, 2, or 3 in the second toss.

$$P(4 \text{ or } 5 \text{ and } 1,2,\text{or } 3) = P(4 \text{ or } 5) \cdot P(1,2 \text{ or } 3)$$
$$= \left(\frac{2}{6}\right)\left(\frac{3}{6}\right) = \frac{1}{6}$$

5. It is known that the probability of obtaining zero defectives in a sample of 40 items is 0.34 whilst the probability of obtaining 1 defective item in the sample is 0.46. What is the probability of

(a) obtaining not more than 1 defective item in a sample?

$$P(\text{not more than } 1) = P(0 \text{ or } 1) = P(0) + P(1) = 0.34 + 0.46 = 0.8$$

(b) obtaining more than 1 defective items in a sample?

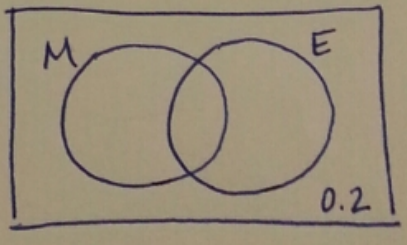
$$P(\text{more than } 1) = 1 - P(0 \text{ or } 1)$$
$$= 1 - 0.8 = 0.2$$

6. The probability that a student passes Mathematics is $\frac{2}{3}$ and the probability that he passes English is $\frac{4}{9}$. If the probability that he will pass at least one subject is $\frac{4}{5}$, what is the probability that he will pass both subjects? (We assume it is based on probability only.)

$P(M) = 2/3 = .667$
$P(E) = 4/9 = .444$
$P(\text{at least } 1) = 4/5 = .8$
$P(\text{none}) = 1 - P(\text{at least } 1) = 0.2$

$P(M) + P(E) + P(\text{none})$
$= 1.311$

The 0.311 is the overlap which is the prob. he passes both subjects.



7. If the independent probabilities that three people A, B and C will be alive in 30 years time are 0.4, 0.3, 0.2 respectively, calculate the probability that in 30 years' time,

(a) all will be alive $(0.4)(0.3)(0.2) = 0.024$

(b) none will be alive $(0.6)(0.7)(0.8) = 0.336$

(c) only one will be alive $(0.4)(.7)(.8) + (0.6)(.3)(.8) + (.6)(.7)(.2) = 0.452$

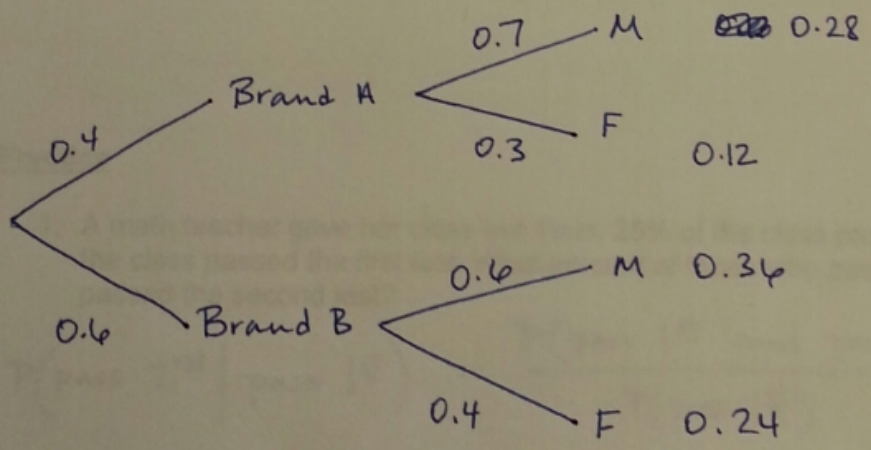
(d) at least one will be alive

$P(\text{at least 1}) = 1 - P(0) = 1 - (.336) = 0.664$

8. A bag contains 5 white marbles, 3 black marbles and 2 green marbles. In each draw, a marble is drawn from the bag and not replaced. In three draws, find the probability of obtaining white, black and green in that order.

$$\left(\frac{5}{10}\right)\left(\frac{3}{9}\right)\left(\frac{2}{8}\right) = \frac{1}{24}$$

9. Of all the smokers in a particular district, 40% prefer brand A and 60% prefer brand B. Of those smokers who prefer brand A, 30% are females, and of those who prefer brand B, 40% are female. What is the probability that a randomly selected smoker prefers brand A, given that the person selected is a female?



$$P(A \mid \text{female}) = \frac{P(A \text{ and female})}{P(\text{Female})} = \frac{0.12}{(.12+.24)} = \frac{1}{3}$$