

## QUANTITATIVE METHODS

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# Assignment 11 SOLUTIONS

This assignment is due *Monday February 28, 2005*.

### Question 1 (4 points)

Two dice are rolled, where one is black and the other is white. Find the following probabilities.

a)  $P(\text{black die is an even number}) = \frac{18}{36} = \frac{1}{2}$

b)  $P(\text{sum is 8}) = \frac{5}{36}$

c)  $P(\text{both dice show even numbers}) = \frac{9}{36} = \frac{1}{4}$

d)  $P(\text{number on black die is larger than number on white die}) = \frac{15}{36}$

### Question 2 (4 points)

A box contains 10 marbles, 6 red and 3 blue and 1 pink. Two marbles are selected at random.

a) Find the probability that the first marble is red and the second one pink.

$$P(R_1P_2) = P(R_1)P(P_2 | R_1) = \frac{6}{10} \frac{1}{9} = \frac{1}{15}$$

b) Find the probability that both marbles are red.

$$P(R_1R_2) = P(R_1)P(R_2 | R_1) = \frac{6}{10} \frac{5}{9} = \frac{1}{3}$$

c) Find the probability that both marbles are pink.

$$P(P_1P_2) = P(P_1)P(P_2 | P_1) = \frac{1}{10} \frac{0}{9} = 0$$

e) Find the probability that one of the two marbles is pink.

$$P(P_1\bar{P}_2 \text{ or } \bar{P}_1P_2) = P(P_1)P(\bar{P}_2 | P_1) + P(\bar{P}_1)P(P_2 | \bar{P}_1) = \frac{1}{10} \frac{9}{9} + \frac{9}{10} \frac{1}{9} = \frac{1}{5}$$

### Question 3 (1 points)

A box contains 8 green marbles and 2 yellow marbles. Three marbles are selected at random. Find the probability that all three marbles are green.

$$P(G_1G_2G_3) = P(G_1)P(G_2 | G_1)P(G_3 | G_1G_2) = \frac{8}{10} \frac{7}{9} \frac{6}{8} = \frac{7}{15}$$

**Question 4** (9 points)

A radio executive considering a switch in his station's format collected from a random sample the following data on the radio preferences of various age groups of listeners.

	Age			
	Young Adult	Middle Age	Older Adult	
Music	14	10	3	27
News/talk	7	15	11	33
Sports	7	9	5	21
	28	34	19	81

Suppose one adult is selected at random from the sample taken by the radio executive. Find the following probabilities

- a)  $P(\text{Music and Middle Age}) = \frac{10}{81}$
- b)  $P(\text{Music or Middle Age}) = P(Mu) + P(Mi) - P(Mu \text{ and } Mi) = \frac{27}{81} + \frac{34}{81} - \frac{10}{81} = \frac{51}{81} = \frac{17}{27}$
- c)  $P(\text{Music given Middle Age}) = P(Mu | Mi) = \frac{10}{34} = \frac{5}{17}$
- d)  $P(\text{Music or Sports}) = P(Mu) + P(Sp) = \frac{27}{81} + \frac{21}{81} = \frac{48}{81} = \frac{16}{27}$
- e)  $P(\text{Music and Sports}) = 0$
- f) Are the events Music and Middle Age independent? Support your answer.  
 No since  $P(Mu) = \frac{27}{81} = \frac{1}{3} \neq P(Mu | Mi) = \frac{5}{17}$
- g) Are the events Music and Middle Age mutually exclusive? Support your answer.  
 No since  $P(Mu \text{ and } Mi) = \frac{10}{81} \neq 0$
- h) Are the events Music or Sports mutually exclusive? Support your answer.  
 Yes since  $P(Mu \text{ and } Sp) = 0$

**Question 5** (5 points)

A single card is drawn from a deck of 52 cards. What is the probability that the card is

- a) a king of diamonds?  $P(K \spadesuit) = \frac{1}{52}$
- b) a king or a diamond?  $P(K \text{ or } \spadesuit) = P(K) + P(\spadesuit) - P(K \spadesuit) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{4}{13}$
- c) a face card?  $P(\text{Face}) = \frac{12}{52} = \frac{3}{13}$
- d) a black face card?  $P(\text{Black Face}) = \frac{6}{52} = \frac{3}{26}$
- e) not a queen?  $P(\bar{Q}) = \frac{48}{52} = \frac{12}{13}$

**Question 6** (3 points)

The academic adviser of a college informs us that in his college of 850 students, 115 students are in a QM class and 116 in an introduction to psychology class. If 55 students are in a QM and an introduction to psychology class, find the probability that if a student is picked a random, he will be in:

- a) only a QM class  $= \frac{60}{850} = \frac{6}{85}$
- b) only a psychology class  $= \frac{61}{850}$
- c) at least one of the two classes  $= \frac{176}{850} = \frac{88}{425}$

