Statistics Multinomial Distributions

Problems 1 - 6 taken from *Elementary Statistics*, Bluman, 7th Edition

1. Use the multinomial formula and find the probabilities for each.

a) $n = 6, X_1 = 3, X_2 = 2, X_3 = 1, p_1 = 0.5, p_2 = 0.3, p_3 = 0.2$

b) $n = 5, X_1 = 1, X_2 = 2, X_3 = 2, p_1 = 0.3, p_2 = 0.3, p_3 = 0.1$

c) $n = 4, X_1 = 1, X_2 = 1, X_3 = 2, p_1 = 0.8, p_2 = 0.1, p_3 = 0.1$

d) $n = 3, X_1 = 1, X_2 = 1, X_3 = 1, p_1 = 0.5, p_2 = 0.3, p_3 = 0.2$

e) $n = 5, X_1 = 1, X_2 = 3, X_3 = 1, p_1 = 0.7, p_2 = 0.2, p_3 = 0.1$

3. According to the manufacturer, M&M's are produced and distributed in the following proportions: 13% brown; 13% red; 14% yellow; 16% green; 20% orange; 24% blue. In a random sample of 12 M&M's, what is the probability of having 2 of each color?

5. A die is rolled 4 times. Find the probability of two 1's, one 2, and one 3.

6. According to Mendel's theory, if tall and colorful plants are crossed with short and colorless plants, the corresponding probabilities are $\frac{9}{16}, \frac{3}{16}, \frac{3}{16}, \textit{and } \frac{1}{16}$ for tall and colorful, tall and colorless, short and colorful, and short and colorless, respectively. If 8 plants are selected, find the probability that 1 will be tall and colorful, 3 will be tall and colorless, 3 will be short and colorful, and 1 will be short and colorless.

7. Suppose we have a bowl with 10 marbles - 2 red marbles, 3 green marbles, and 5 blue marbles. We randomly select 4 marbles from the bowl, with replacement. What is the probability of selecting 2 green marbles and 2 blue marbles?

8. There are two chess players. The probability that player A will win is 0.40, the probability that player B will win is 0.35, and the probability of a draw is 0.25. If these two chess players played 12 games, what is the probability that Player A would win 7 games, Player B would win 2 games, and the remaining 3 games would be drawn?