**MGF 1106 – Chapters 11 Practice**
**Counting and Probability**

**I. Using the digits in the set {0, 1, 2, 3, 4, 5, 6}, find the number of possibilities in each category.**

1. Three-digit numbers.
2. Even three-digit numbers.
3. Three-digit numbers without repeated digits.
4. Three-digit multiples of five without repeated digits.

**II. Follow the directions provided.**

5. **Tossing Coins:** Construct a tree diagram showing all possible results when a fair coin is tossed four times, if the third toss must be different than the second.
6. **Building Numbers from Sets of Digits:** Using only digits from the set {0, 1, 2} how many three-digit numbers can be written which have no repeated odd digits? (Hint: make a systematic list)
7. **Building Words from Sets of Letters:** How many five-letter "words" without repeated letters is possible using the English alphabet? (Assume that any five letters make a "word")
8. **Building Words from Sets of Letters:** Using the Russian alphabet (which has 32 letters) and allowing repeated letters, how many five-letter "words" are possible?
9. How many different outfits can Ellen wear if she has 5 dresses, 3 hats, and 2 pairs of shoes? (Assume an "outfit" consists of a dress, a hat, and a pair of shoes).

**III. Evaluate each expression.**

10. $5!$

11. $\frac{3256!}{3254!}$

12. ${}_{12}P_4$

13. ${}_{7}C_3$

**IV. Selecting Groups of Basketball Players:** If there are twelve players on a basketball team, find the number of choices the coach has in selecting each of the following.

14. Four players to carry the team equipment
15. Two players for guard positions and two for forward positions.
16. Five starters and five subs.
17. A set of three or more of the players.

**V. Choosing Subsets of Letters: Four distinct letters are to be chosen from the set**
{A, B, C, D, E, F, G}

**Determine the number of ways to obtain a subset that includes each of the following.**

18. The letter D.
19. Both A and E.
20. Either A or E, but not both.
21. Equal numbers of vowels and consonants.
22. More consonants than vowels.

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**VI. Drawing Cards:** A single card is chosen at random from a standard 52-card deck. Find the odds against its being each of the following.

23. A heart.
24. A red queen.
25. A king or a black face card.

**VII. Genetics of Cystic Fibrosis:** The chart represents genetic transmission of cystic fibrosis. C denotes a normal gene while c denotes a cystic fibrosis gene. (Normal is dominant.) Both parents in this case are Cc, which means that they inherited one of each gene, and are therefore carriers but do not have the disease.

| | | Second Parent | |
|---|---|---|---|
| | | C | c |
| First Parent | C | | $C_c$ |
| | c | | |

26. Complete the chart, showing all four equally likely gene combinations.
27. Find the probability that a child of these parents will also be a carrier without the disease.
28. What are the odds that a child of these parents actually will have cystic fibrosis?

**VIII. Rolling Dice:** A pair of dice is rolled. Find the following.

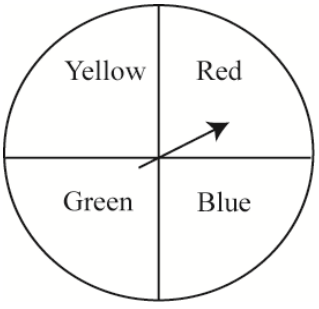
29. The probability of "doubles" (the same number on both dice).
30. The probability of a sum greater than 2.
31. The odds against a sum of "7 or 11".
32. The probability of a sum that is even and less than 5.

**IX. Drawing Cards:** Two cards are drawn, without replacement, from a standard 52-card deck. Find the probability of each event.

33. Both cards are red.
34. Both cards are the same color.
35. The second card is a queen, given that the first card is an ace.
36. The first card is a face card and the second is black.

**X. Answer the following.**

37. Use the spinner to determine the probability of the event that we obtain yellow exactly twice in three spins.




38. Explain the difference between *empirical* and *theoretical* probabilities.

**XI. A survey of 350 college students is taken. Each student is asked the type of college attended (public or private) and the family's income level (low, middle, high). Use the data in the table to solve the following, express the probabilities as simplified fractions.**

| | Public | Private | Total |
|---|---|---|---|
| **Low** | 120 | 20 | 140 |
| **Middle** | 110 | 50 | 160 |
| **High** | 22 | 28 | 50 |
| **Total** | 252 | 98 | 350 |

39. If one of the students is randomly selected, find the probability that the student is not from a high-income family.

40. If one of the students is randomly selected, find the probability that the student attends a public college given that the student is from a middle-income family.

41. If one of the students is randomly selected, find the probability that the student attends a private college and is not from a middle-income family.

42. If one of the students is randomly selected, find the probability that that the student is from a low-income family given the student attends a private college.

**XII. In a certain mathematics class, the probabilities have been empirically determined for various numbers of absences on any given day. These values are shown in the table below. Find the following probabilities, rounded to the nearest hundredth.**

| Number of Absences | Probability |
|---|---|
| 0 | 0.12 |
| 1 | 0.43 |
| 2 | 0.24 |
| 3 | 0.14 |
| 4 | 0.07 |

43. that 1 or 2 students will be absent.

44. that less than 3 students will be absent.

45. that 0 or 4 students will be absent.

46. that 3 students will be absent.

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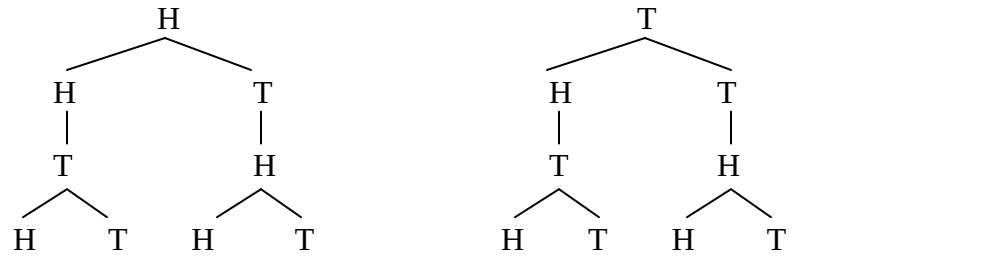
**ANSWERS:**

1. 294
2. 168
3. 180
4. 55
5. 

Here is the list: HHTH, HHTT, HTHH, HTHT, THTH, THTT, TTHH, TTHT
6. 12
7. 7,893,600
8. 33,554,432
9. 30
10. 120
11. 10,598,280
12. 11,880
13. 35
14. 495
15. 2,970
16. 16,632
17. 4,017
18. 20
19. 10
20. 20
21. 10
22. 25
23. 3 to 1
24. 25 to 1
25. 11 to 2
26.

| | |
|---|---|
| CC | Cc |
| cC | cc |

27. $\frac{1}{2}$
28. 1 to 3
29. $\frac{1}{6}$
30. $\frac{35}{36}$
31. 7 to 2
32. $\frac{1}{9}$
33. $\frac{25}{102}$
34. $\frac{25}{51}$

35. $\frac{4}{51}$
36. $\frac{3}{26}$
37. $\frac{3}{64}$
38. Empirical probability is taken from an actual experiment that has been performed while theoretical probability is what should happen based on the sample space.
39. $\frac{6}{7}$
40. $\frac{11}{16}$
41. $\frac{24}{175}$
42. $\frac{10}{49}$
43. 0.67
44. 0.79
45. 0.19
46. 0.14

# Formulas & Tables you will be provided on the test day:

### Sample Space for a Standard Deck of 52 Cards:

Spades and Clubs are Black
Diamonds and Hearts are Red
King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3, 2, Ace

### Sample Space for the Roll of Two Dice

| D2 / D1 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **1** | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) |
| **2** | (2,1) | (2,2) | (2,3) | (2,4) | (2,5) | (2,6) |
| **3** | (3,1) | (3,2) | (3,3) | (3,4) | (3,5) | (3,6) |
| **4** | (4,1) | (4,2) | (4,3) | (4,4) | (4,5) | (4,6) |
| **5** | (5,1) | (5,2) | (5,3) | (5,4) | (5,5) | (5,6) |
| **6** | (6,1) | (6,2) | (6,3) | (6,4) | (6,5) | (6,6) |

$$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$

$$P(A\ and\ B) = P(A) \cdot P(B)$$