Math 3201 **Chapter 3 - Permutation Probability**

1. A 4-digit PIN number can begin with any digit except zero and the remaining digits have no restriction. If repeated digits are allowed, find the probability of the PIN code beginning with a number great than 7 and ending with a 3.

$P_r = \frac{F}{T}$

0 – 9 10 digits

$\text{total} = \underline{9} \times \underline{10} \times \underline{10} \times \underline{10}$

$\text{Fav} = \underset{\substack{8 \\ \text{or} \\ 9}}{\underline{2}} \times \underline{10} \times \underline{10} \times \underset{3}{\underline{1}} = 200$

$P_r = \frac{200}{9000}$

$= 0.022$

or

2.2%

2. A security code consists of 6 digits, which may be any number from 0 to 9. The code can begin with any digit, except zero. No repetitions are allowed. Determine the probability, to the nearest hundredth, a particular code begins with an even digit.

$\text{Total} = \underline{9} \times \underline{9} \times \underline{8} \times \underline{7} \times \underline{6} \times \underline{5} = 136080$

$\text{Fav} = \underline{4} \times \underline{9} \times \underline{8} \times \underline{7} \times \underline{6} \times \underline{5} = 60480$

even digits: 2, 4, 6, 8 → 4

$P_r = \frac{F}{T} = \frac{60480}{136080} = 0.44 = 44\%$

3. Jeff, Amy and four other students are standing in a line. Determine the probability Jeff and Amy are standing together.

$$\text{total} = \underline{6} \times \underline{5} \times \underline{4} \times \underline{3} \times \underline{2} \times \underline{1} = 6! = 720$$

$$5$$

$$\text{favs} = \boxed{\underset{J}{\underline{2}} \times \underset{A}{\underline{1}}} \times \underline{4} \times \underline{3} \times \underline{2} \times \underline{1} = 2! \cdot 5! = 240$$

$$P_r = \frac{f}{t} = \frac{240}{720} = 0.33 \text{ or } 33\%$$

4. Jeff, Amy and four other students are standing in a line. Determine the probability Jeff and Amy are not standing together.

$$100\% - 33\% = 67\%$$

5. There are 7 accountants and 4 marketing agents at a conference. Find the probability of 3 different door prizes being awarded to all accountants or all marketing agents.

3 accountants and 0 agents

or

0 accountants and 3 agents

$$_7P_3 \times {}_4P_0 + {}_7P_0 \times {}_4P_3$$

$$210 \times 1 + 1 \times 24$$

$$= 210 + 24$$

$$= 234$$

$$\text{total} = {}_{11}P_3 = 990$$

$$P = \frac{f}{t} = \frac{234}{990}$$

$$= 0.24$$

or

24%

6. At a family gathering, three different door prizes are given away. There are tables with specific age groups. There are 5 children at one table, 8 teenagers at another, 15 adults and 9 seniors. Find the probability of:

$$\text{total} = {}_{37}P_3 = 46620$$

(A) Only seniors win a prize.

$$\text{fav} = {}_9P_3 = 504$$

$$P = \frac{\text{fav}}{\text{total}} = \frac{504}{46620} = \frac{126}{666}$$

(B) All three prizes go to the same table. 3 children or 3 teens or 3 adults or 3 seniors

$$_5P_3 = 60$$
or +
$$_8P_3 = 336$$
or +
$$_{15}P_3 = 2730$$
or +
$$_9P_3 = 504$$
$$\overline{3630}$$

$$P = \frac{f}{t}$$

$$P = \frac{3630}{46620} = \frac{121}{1554} = 0.078 \text{ or } 7.8\%$$

(C) At least one prize goes to the children

1 or 2 or 3

$$_5P_1 \times {}_{32}P_2 = 5 \times 992 = 4960$$
or + +
$$_5P_2 \times {}_{32}P_1 = 20 \times 32 = 640$$
or + +
$$_5P_3 \times {}_{32}P_0 = 60 \times 1 = 60$$
$$\overline{5660}$$

$$P = \frac{f}{t}$$

$$= \frac{5660}{46620}$$

$$= \frac{283}{2331} \text{ or } 0.121$$

or 12.1%

(D) No prize goes to the seniors.

$${}_9P_0 \times {}_{28}P_3 = 1 \times 19656$$

$$P = \frac{f}{t} = \frac{19656}{46620} = \frac{78}{185} = 0.426$$

or

42.6%