Worksheet 4.3
Practice with Permutations and Combinations

1 Calculations

Calculate each of the following:

a) ${}_{10}P_2$

b) ${}_{7}P_7$

c) ${}_{5}P_3$

d) ${}_{12}P_5$

e) ${}_{3}P_1$

2 Permutations

1) 10 students are to be lined up for lunch. How many different lines can we form?

2) 128 tennis players are entered in a tournament. If the top 32 players are seeded, how many ways could we assign the seeds to 32 different players?

3) 100 Senators are being considered to chair the 17 committees in the US senate. How many different ways could the chair people be selected, assuming that no one chairs more than 1 committee?

4) 8 friends go to the movies and Mike insists on being third in line to get tickets. If his wife always stands in front of him in line, how many ways can the 8 friends line up at the ticket window?

5) The same 10 students wish to go to lunch. How many ways could we line up 5 of them, send them to lunch and then line up the remaining 5?

6) A bookshelf contains 3 math, 3 science and 3 social studies textbooks. If all of the books are the different, how many ways can the books be arranged on the shelf?

6b) How many ways can the books be arranged such that the books of the same type are together?

3 Permutations and Combinations

1) A baseball team has 25 players on its roster. How many ways are there to pick nine starters?

2) The local bank branch has a pool of 8 tellers and 8 customer service reps (CSRs). How many ways can the manager select 4 tellers and 2 CSRs to work on a given day?

3) Ping-pong balls labeled 1-15 are placed in a bag. How many ways can I reach into the bag and pull out either four or six balls?

4) How many ways are there to select a committee of 6 people from a group of 12 and also select a committee president and secretary?

5) There are 10 people at a party, and each pair of people shakes hands exactly once. How many handshakes were there?

6) How many subsets of a 15-element set have either four or six elements?

4.3 Worksheet – Permutations, Combinations, and Probability
COUNTING EXERCISES

1) Calculator Exercises. Compute the following.
a) $7! =$ b) ${}_3P_3 =$ c) ${}_{48}C_3 =$

2) Determine which method to use to solve, and solve.
a) In how many ways can 5 different cars be parked in a row in a parking lot?

b) In how many different ways can 4 horses be lined up for a race?

c) Suppose 40 cars start at the Indianapolis 500. In how many ways can the top three cars finish the race?

d) **Michigan Lotto**. The state of Michigan runs a 6-out-of-44-number lotto twice a week that pays at least $1.5 million. You purchase a card for $1 and pick any 6 numbers from 1 to 44. If your 6 numbers match those that the state draws, you win.

i) How many possible 6-number combinations are there for drawing?
ii) What is the probability of winning the lotto?
iii) Suppose it takes 10 minutes to pick your numbers and buy a ticket. How many tickets can you buy in 4 days.
iv) How many people would you have to hire to buy all the tickets and ensure that you win?

e) **Full House**. Suppose you are dealt 5 cards from a standard 52-card deck. Determine the probability of being dealt a full house (3 of one, 2 of another) by answering the following:

i) How many ways can 5 cards be selected from a 52-card deck?
ii) Each deck contains 4 two's, 4 three's, and so on. How many ways can three of the same card be selected from the deck?
iii) The remaining 2 cards must be different from the 3 chosen. For example, if we drew three kings, the 4^{th} card cannot be a king. After selecting three of a kind, there are 12 of the same rank of card remaining in the deck that can be chosen. For example, if we have three aces, then we can choose two's, three's and so on. Of the 12 ranks remaining, we choose 1 of them and there are 4 cards in each rank. How many ways can we select the remaining 2 cards?
iv) Use the Multiplication Rule to compute the probability of obtaining a full house. That is, what is the probability of selecting three of a kind and two cards that are alike?

0.001 44
120
24
59280
7,059,052
0.000 000 14
576
12,256
2,598,960
52
72