ESE/EEO 306
Random Signals and Systems
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Assignment 2A
Combinatorics

1 Assignment

1. A committee of 2 people is to be formed out of 6 people. How many different committees are possible?

2. If 12 people are to be divided into 3 committees of sizes 3, 4 and 5, respectively, how many different divisions are possible?

3. (a) Shuffle a deck of 52 cards. How many possible outcomes are there?
   (b) In how many ways can you distribute, that is, divide a deck of 52 cards among 4 players?

4. We draw two cards at random from a deck of 52 cards. What is the probability that the drawn cards are both red? Note that the cards are drawn without replacement.

5. We draw four cards at random from a deck of 52 cards. What is the probability that the drawn cards are all aces? Note that the cards are drawn without replacement.

6. We draw five cards at random from a deck of 52 cards. What is the probability of getting three aces and two kings? Note that the cards are drawn without replacement.

7. Imagine that we have a coin that comes up head with probability 0.5. We want to generate bits 0 and 1 randomly.
   (a) How can we use that coin to generate the bit 1 with probability 0.25
   (b) How might you generalize this to a probability of $m/2^n$, for any m between 0 and 2^n. As an example, you can use $n = 3$.
   (Hint: You can flip the coin as many times as you want.)

8. Three cards are dealt without replacement from a well-shuffled 52-card deck.
   (a) Determine the probability P(three of a kind (same rank)).
   (b) Determine the probability P(two of a kind and one of another rank).
   (c) Determine the probability P(three cards of different ranks).
   (d) Show that the above probabilities sum up to 1.