Items to Review

- Numerical summaries: mean, median, mode, standard deviation, variance, range, class frequency, relative class frequency, z-score.
- Listing sample spaces for experiments and assigning probabilities to sample points.
- Finding probabilites of unions, intersections and complements.
- Complements: $P(A^c) = 1 - P(A)$
- Unions: $P(A \bigcup B) = P(A) + P(B) - P(A \bigcap B)$
- Conditional probability: $P(A|B) = \frac{P(A \bigcap B)}{P(B)}$
- Intersections: $P(A \bigcap B) = P(A|B)P(B) = P(B|A)P(A)$
- Law of Total Probability: $P(A) = P(A|B)P(B) + P(A|B^c)P(B^c)$
- Combinations: Choose r elements from N where order doesnt matter $C_r^N = \frac{N!}{r!(N-r)!}$
- Permutations: Choose r things from N where the order does matter $P_r^N = \frac{N!}{(N-r)!}$

Examples to Review.

1. How many ways can one choose 3 people from a group of 8 *and* arrange them in order?
   The answer is of course $P_3^8 = 336$, but lets count another way as well to see the relationship between combinations and permutations. How many ways can we choose 3 people from the group of 8? The answer is $C_3^8 = 56$. Now, given a set of 3 people, how many ways can we order them?
   (number of ways to choose first person)(number of ways to choose second person)(number of ways to choose last person) = (3)(2)(1) = 6. Thus we have 56 sets of 3 people to choose from and 6 ways to arrange each group of 3, so the total number of ways to choose 3 people *and* arrange them in order is (56)(6) = 336. We see that this agrees with P_3^8.

2. We survey shoppers at a mall and ask them two questions: Did they shop at store X?, and Did they see and ad for store X? The results are:

	Shopped at X	Didn't shop at X	Total
Saw ad	105	20	125
Didn't see add	20	65	85
Total	125	85	210

Experiment: We choose a person from the survey at random.
Event A: Person shopped at X
Event B: Person saw add for X

- $P(A) = 125/210$
- $P(B) = 125/210$
- $P(A \bigcup B) = (105 + 20 + 20)/210 = 145/210$
- $P(A \bigcap B^c) = 20/210$
- $P(A|B) = 20/125$

3. A machine has 4 components A, B, C and D. All are needed and are independent. Suppose the probability of the parts working is $P(A) = P(B) = P(C) = 0.97$ and $P(D) = 0.95$. What is the probability that the machine works (all parts work?)

   We are interested in $P(A \bigcap B \bigcap C \bigcap D)$, since the events are independent $P(A \bigcap B \bigcap C \bigcap D) = P(A)P(B)P(C)P(D) = (0.97)(0.97)(0.97)(0.95) = 0.867$

4. Suppose of 400 stocks 19 have outstanding prospects. You choose 2 of the stocks at random. What is the probability at least one of the stocks you choose has outstanding prospects?

   Define the event A = At least one of the chosen stocks has outstanding prospects.
   We will use the rule $P(A) = 1 - P(A^c)$. So we need to find $P(A^c)$.

   How many total ways can we choose the stocks? $C_2^{400} = 79800$
   How many ways can we choose 2 stocks from the ones that don't have outstanding prospects? (number of ways A^c can occur)
   $C_2^{381} = 72390$
   Thus $P(A^c) = 0.9171$ and $P(A) = 0.0929$.