Fall 2006
Math 141 Exam 3 Topics
courtesy: Kendra Kilmer
(covering Sections 7.1-7.6 and 8.1-8.3)

Section 7.1

- An **experiment** is an activity with an observable result.
- The **outcome** or **sample point** is the observed result.
- The **sample space**, S, is the set of all possible outcomes.
- An **event** is a subset of the sample space.
- All set operations (union, intersection, complement) are valid with events.
- Two events are **mutually exclusive** if $E \cap F = \emptyset$
- The **impossible event** is the empty set. The **certain event** is the sample space.

Sections 7.2 and 7.3

- Suppose we repeat an experiment n times and an event E occurs m of those times. Then $\frac{m}{n}$ is called the **relative frequency** of the event E.
- The **probability of an event** is a number between 0 and 1 that represents the likelihood of the event occuring. The larger the probability, the more likely the event is to occur.
- An event which consists of exactly one outcome is called a **simple event** of the experiment.
- The table that lists the probability of each outcome in an experiment is known as the **probability distribution**.
- For a **uniform sample space** with n outcomes the probability of each outcome is $\frac{1}{n}$.
- To find the probability of an event E, add the probabilities of the simple events of E. Recall $P(\emptyset) = 0$ and $P(S) = 1$.
- Rules of Probability
  - $P(E \cup F) = P(E) + P(F) - P(E \cap F)$
  - If E and F are mutually exclusive, then $P(E \cap F) = 0$
  - $P(E) = 1 - P(E^c)$

Section 7.4

- If S is a uniform sample space then $P(E) = \frac{n(E)}{n(S)}$.

Sections 7.5 and 7.6

- If A and B are events in an experiment and $P(A) \neq 0$, then the **conditional probability** that the event B will occur given that the event A has already occurred is $P(B|A) = \dfrac{P(A \cap B)}{P(A)}$
- **Product Rule:** $P(A \cap B) = P(A) \cdot P(B|A)$
- Tree Diagrams
- If A and B are **independent events** then $P(A|B) = P(A)$ and $P(B|A) = P(B)$. Futhermore, two events are independent if and only if $P(A \cap B) = P(A) \cdot P(B)$
- Bayes' Theorem

Section 8.1

- A **random variable** is a rule that assigns a number to each outcome of an experiment.
- A **finite discrete** random variable is one which can only take on a limited number of values that can be listed.
- An **infinite discrete** random variable is one which can take on an unlimited number of values that can be listed in some sort of sequence.
- A random variable is **continuous** if the values it may assume comprise an interval of real numbers.
- We use **histograms** to visually represent probability distributions of random variables.

Sections 8.2, 8.3

- For a random variable X that takes on the values x_1, $x_2, \ldots x_n$ with associated probabilities p_1, $p_1, \ldots p_n$ The **expected value** of the random variable X is defined by $E(X) = x_1p_1 + x_2p_2 + \cdots + x_np_n$
- A **fair game** is one in which the expected value of both players' net winnings is zero. (i.e. $E(X) = 0$)
- If $P(E)$ is the probability of an event occuring then $\dfrac{P(E)}{P(E^c)}$ is the **odds for the event occuring** and $\dfrac{P(E^C)}{P(E)}$ is the **odds against the event occuring**.
- If the odds of an event occuring are a to b, then the probability that event will occur is $P(E) = \dfrac{a}{a+b}$.
- The **median** is the middle value when the data points are listed in increasing or decreasing order if there are an odd number of values. The median is the average of the middle two values if there are an even number of values.
- The **mode** is the value that occurs most frequently.
- The **variance** is a measure of how spread out the distribution is away from the mean. The **standard deviation** (also a measure of spread) is the square root of the variance.
- You can use 1-Var Stats to compute the mean, median, standard deviation, and variance. Make sure that you enter 1-Var Stats L_1, L_2 on the home screen if you enter in a probability distribution into L_1 and L_2.
- If a random variable has a mean of μ and a standard deviation of σ then **Chebychev's Inequality** allows you to estimate the probablity that a randomly selected outcome will be within k standard deviations of the mean. It states:

$$P(\mu - k\sigma \leq X \leq \mu + k\sigma) \geq 1 - \frac{1}{k^2}$$