Probability, homework 2, due September 20th.


**Exercise 1.** Two dice are thrown. Let $E$ be the event that the sum of the dice is odd, let $F$ be the event that at least one of the dice lands on 1, and let $G$ be the event that the sum is 5. Describe the events $EF$, $E \cup F$, $FG$, $EF^c$, and $EFG$.

**Exercise 2.** In an experiment, die is rolled continually until a 6 appears, at which point the experiment stops. What is the sample space of the experiment? Let $E_n$ denote the event that $n$ rolls are necessary to complete the experiment. What points in the sample space are contained in $E_n$? What is $(\bigcup_{n=1}^{\infty} E_n)^c$?

**Exercise 3.** A hospital administrator codes incoming patients suffering gunshot wounds according to whether they have insurance (coding 1 if they do and 0 if they do not) and according to their condition, which is rated as good (g), fair (f), or serious (s). Consider an experiment that consists of the coding of such a patient.

(i) Give the sample space of this experiment.
(ii) Let $A$ be the event that the patient is in serious condition. Specify the outcomes in $A$.
(iii) Let $B$ be the event that the patient is uninsured. Specify the outcomes in $B$.
(iv) Give all the outcomes in the event $B^c \cup A$.

**Exercise 4.** Prove that $(\bigcup_{i=1}^{\infty} E_i) F = \bigcup_{i=1}^{\infty} E_i F$.

**Exercise 5.** Let $E$, $F$, and $G$ be three events. Find expressions for the events so that, of $E$, $F$, and $G$,

(i) only $E$ occurs;
(ii) both $E$ and $G$, but not $F$, occur;
(iii) at least one of the events occurs;
(iv) at least two of the events occur;
(v) all three events occur.

**Exercise 6.** Suppose that $A$ and $B$ are mutually exclusive events for which $\mathbb{P}(A) = 0.3$ and $\mathbb{P}(B) = 0.5$. What is the probability that 

(i) either $A$ or $B$ occurs?
(ii) $A$ occurs but $B$ does not?
(iii) both $A$ and $B$ occur?

**Exercise 7.** If $N$ people, including $A$ and $B$, are randomly arranged in a line, what is the probability that $A$ and $B$ are next to each other? What is the people were arranged in a circle?

**Exercise 8.** An urn contains $n$ red and $m$ blue balls. They are withdrawn on at a time until a total of $r$ ($r \leq n$) red balls have been withdrawn. Find the probability that a total of $k$ balls are withdrawn.