1. Administrivia

(1) Course Information
   - You can pick up your midterm at the end of the discussion section if you haven’t done it so.
   - Homework 7 is posted, and it’s due on Tuesday, March 20, at 2:30pm.

2. Probability

Not Rule. \( \Pr(\overline{E}) = 1 - \Pr(E) \)

Exercise 1. Which is more likely: rolling a total of 9 when two dice are rolled or rolling a total of 9 when three dice are rolled?

Addition Rule. \( \Pr(E \cup F) = \Pr(E) + \Pr(F) - \Pr(E \cap F) \)

Exercise 2. A card is drawn randomly from a deck of ordinary playing cards. You win $10 if the card is a spade or an ace. What is the probability that you will win the game?

Conditional Probability. \( \Pr(E \mid F) = \frac{\Pr(E \cap F)}{\Pr(F)} \)

Multiplication Rule. \( \Pr(E \cap F) = \Pr(E \mid F) \times \Pr(F) \)

Exercise 3. Shuffle a deck of 52 cards. What is the probability that the first two cards are aces?

Independence. \( \Pr(F \mid E) = \Pr(F) \)

Exercise 4. In a binary communication channel the receiver sends zero or one, but at the receiver there are three possibilities: a zero is received, a one is received, and an undecided bit is received (which means that the receiver will ask the transmitter to repeat the bit). Define the event \( T_1 = \{ 1 \text{ is sent} \} \) and \( T_0 = \{ 0 \text{ is sent} \} \) and assume that they are equally probable. At the receiver we have three events: \( R_1 = \{ 1 \text{ is received} \} \), \( R_0 = \{ 0 \text{ is received} \} \), \( R_u = \{ \text{cannot decide the bit} \} \). We assume that we have the following conditional probabilities: \( \Pr(R_0 \mid T_0) = \Pr(R_1 \mid T_1) = 0.9 \), \( \Pr(R_u \mid T_0) = \Pr(R_u \mid T_1) = 0.09 \).

(1) Find the probability that a transmitted bit is received as undecided.
(2) Find the probability that a bit is received in error.
(3) Given that we received a zero, what is the conditional probability that a zero was sent? What is the conditional probability that a one sent?

\( (E \cup F)(E \cup G) \)

Date: March 16, 2007.