DC FELLOWS PROGRAM
MATH IMMERSION SUMMER COURSE

PROBABILITY
JUNE 10, 2008

1. MULTIPLE CHOICE PROBLEMS

(1) A meteorologist predicts that there is a 40% chance of a thunderstorm and a 10% chance that a thunderstorm will produce hail. What is the probability of a thunderstorm with hail occurring?

  (a) 4%
  (b) 10%
  (c) 30%
  (d) 50%

(2) A two-sided coin is unfairly weighted so that when it is tossed, the probability that heads will result is twice the probability that tails will result. If the coin is to be tossed 3 separate times, what is the probability that tails will result on exactly two of these tosses?

  (a) 2/9
  (b) 3/8
  (c) 4/9
  (d) 2/3

	Diagnosis is Positive	Diagnosis is Negative
Smoker	25	5
Non-Smoker	15	155

(3) The data in the table above show the diagnoses of 200 subjects consisting of smokers and non-smokers who were tested for lung cancer in a certain clinic. If one of the 200 subjects is randomly selected, what is the probability that he was positively diagnosed as having lung cancer, given that the subject was a smoker?

  (a) 1/5
  (b) 1/6
  (c) 5/8
  (d) 5/6

(4) Only one of 10 remote controls in a box is defective. The remote controls are tested one at a time. If the first three remote controls tested are not defective, what is the probability that the fourth device tested is defective.

   (a) 99/100
   (b) 1/10
   (c) 1/7
   (d) 7/10

(5) A jar contains 3 red marbles, 5 white marbles, 1 green marbles, and 15 blue marbles. If one marble is picked at random from the jar, what are the odds that it is red?

   (a) 1:8
   (b) 8:1
   (c) 1:7
   (d) 7:1

(6) A standard 6-sided die is rolled several times. What is the probability that a 3 will not appear before the third roll of the die?

   (a) 1/3
   (b) 25/216
   (c) 25/36
   (d) 1/216

(7) If there are three people in a room, what is the probability that at least two of them will share a birthday? Assume the year has 365 days.)

   (a) 0.67
   (b) 0.05
   (c) 0.008
   (d) 0.33

2. Structured response problems

(1) Consider the following game: A standard six-sided die is rolled. If the number showing is divisible by 3, Player B must give Player A \$5. If any other number shows, Player B must give player A \$2. What can Player A expect to win on average per round in the long term (i.e. what is Player A's expected value)? What about Player B? Do your answers make sense?

(2) One percent of the people in a certain country actually have Disease X. When screening for the disease, there is a 1% chance of getting a *false positive result*, i.e. the probability of a well person testing positive for the disease is 1% $P(postive|well) = 0.01$). Similarly, there is a 1% chance of getting a false negative. What is the probability that a randomly selected individual actually has the disease, given that he tested positive?