Directions: You may work to solve these problems in groups, but all written work must be your own. See "Guidelines and advice" on the course webpage for more information.

1. There are roughly 669 Martian days in a Martian year. What is the fewest number of Martians needed before the probability that two share the same birthday is greater than 50%? (Note: you'll need a computer or advanced calculator to compute the probabilities.)

2. Suppose that a fair die is rolled 4 times. Let A be the event that at least one 6 is rolled, let B be the event that the rolls give distinct values, and let C be the event that the first roll is odd.

   (a) What is the sample space Ω? What is $|\Omega|$?

   (b) Find $\Pr(A)$, $\Pr(B)$, and $\Pr(C)$.

   (c) Find $\Pr(A \cap B)$, $\Pr(A \cap C)$, and $\Pr(B \cap C)$.

   (d) Find the conditional probabilities $\Pr(A|B)$, $\Pr(B|A)$, $\Pr(A|C)$, $\Pr(C|A)$, $\Pr(B|C)$, and $\Pr(C|B)$.

   (e) For each of the three pairs of events (namely $\{A, B\}$, $\{A, C\}$, and $\{B, C\}$), determine if the pair of events is independent, positively correlated, or negatively correlated.

3. A poker hand is dealt from a shuffled deck, so each set of 5 cards is equally.

   (a) What is the probability that the hand contains at least three cards with the same rank (i.e. the hand is 3-of-a-kind, a full house, or 4-of-a-kind)?

   (b) Two of the cards in the hand are revealed: the 7 of clubs and the 3 of diamonds. Now what is the probability that the hand contains at least 3 cards with the same rank?