Tour 20 - Probability Puzzles

1. A (female) contestant on a game show is shown three doors by the (male) host. Behind one of these there is a car, and behind each of the other two there is a goat. She chooses one of the doors, hoping of course to get the car. Before the door is opened, the host (who knows what's behind each door) opens one of the remaining two doors to reveal a goat. At this point he offers her the chance to switch her choice if she so wishes. Should she switch, and if so, how does that change the probability of winning the car?

2. A lottery ticket has four boxes (labelled A, B, C, and D) which you scratch out in alphabetical order. Each box reveals a different number. You win if you stop when you uncover the *largest* of the four numbers. Suppose you uncovered a 125 under the A and 407 under the B. Should you continue uncovering numbers?

3. You are given a one true or false question on a test. If you get the question right, your final mark is increased by one percent, but if you get the question wrong, your final mark is decreased by one percent. You can guess, or you can copy from your neighbour, but you know from experience that your neighbour answers incorrectly 20% of the time. Besides, there is a ten percent chance that the teacher would catch you cheating, and in this case, she would deduct five percent from your final mark. Moral issues aside, what should you do: copy from your neighbour, or randomly guess on the question?

4. Two players alternately shoot themselves with a six-shooter, only one chamber of which contains a bullet. *(This is called Russian Roulette)*. You have the first shot, so you decide the rules. Either both players take turns shooting the *next* chamber, or both players randomly spin the chamber before shooting. Naturally, you want to maximize your chances of surviving. Should you spin first and shoot, or shoot without spinning?

5. Alison, Bernon, and Chantel play the following game. They take turns (in the order $A, B, C, A, B, C, \ldots$) rolling one die. Alison wins if she rolls 1, 2, or 3 on her turn. Bernon wins if he rolls 4 or 5 on his turn. Chantel wins if she rolls 6 on her turn. They keep repeating this until there is a winner. What is the probability that Alison wins the game?

   For example, if Alison rolls 5, then it's Bernon's turn. Say he rolls 6. Then it's Chantel's turn. Say she rolls 6. Then Chantel wins.