STAT2203/7203: Week 3 Practical Questions

1. Warren Buffet challenges Bill Gates to a game of dice. Gates picks one of the following four sided dice, then Buffet chooses one of the remaining dice. Whoever rolls the highest number wins. The three dice have the following numbers on their faces:

   (die A): 12, 10, 3, 1

   (die B): 9, 8, 7, 2

   (die C): 11, 6, 5, 4

   What is the probability of Buffett winning the game, assuming he chooses his die to maximise his probability of winning?[1]

2. Alice has several close friends, three male and four female, who are all about the same height as each other. She is wondering if the males around this height tend to be heavier than females on average. She sets up a scale in her floor and secretly weighs each friend when they visit. The resulting weights are given in the table below

   Table 1: Weight (kg)

Female	56	49	52	70
Male	72	68	86	

   (a) How many ways can the 7 friends be allocated to two groups of size 4 and 3?

   (b) How many allocations would lead to a difference in the sample means of the two groups (Males - Females) greater than or equal to the observed difference of 18.58 kg?

   (c) Calculate the exact P-value for a randomisation test to determine whether males around this height tend to be heavier than females on average.

3. Consider the water cooling system schematically depicted in Figure ??. The system has four unreliable components: two identical pumps (P1 and P2) and two valves (V1 and V2). The system works if, in the diagram, there is a path from left to right traversing only working components.
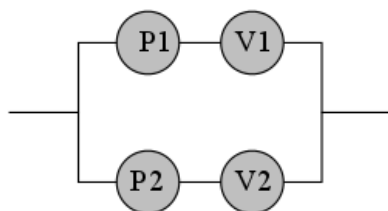

Figure 1: The system works if there is a path from left to right with working components.

   We assume that the pumps and valves fail independently of each other and that the probability that each pump works is 0.9 and the probability that each valve works is 0.8. Calculate the probability that the system works.

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[1] Adapted from Janet Lowe (1998) *Bill Gates Speaks*, John Wiley & Sons

4. An exit poll is a survey of voters taken immediately after they have exited a polling station. Supporters of one party, the Tastycrats, will agree to participate in an exit poll when asked with probability 0.6, whereas supporters of other parties will agree to participate in an exit poll when asked with probability 0.8. Suppose that 52% of voters in the electorate vote for the Tastycrats. What is the probability that a person voted for the Tastycrats given they participated in the exit poll?