L2 Probability Practice #6

1. A student marks both of two six-sided dice with the numbers 1, 1, 2, 2, 2, 3. He then rolls the two dice and adds their score.

   a) What is the probability that the result is odd?

   b) What is the probability that the total is five?

   c) If the total is four, what is the probability one of the dice is a "3"?

2. A bag contains 80 marbles, which students can earn a chance to draw from.
   - 20 small red ones.
   - 7 large red ones.
   - 25 small blue ones
   - 8 large blue ones.

   If a large one is selected (at random) the student wins a small prize.

   a) What is probability that if two randomly selected marbles are drawn at the same time that they will both be large?

   b) What is the probability a random marble is large, given that it is red?

   c) If two marbles are drawn, and one of them is large, what is the probability that the other is large too?

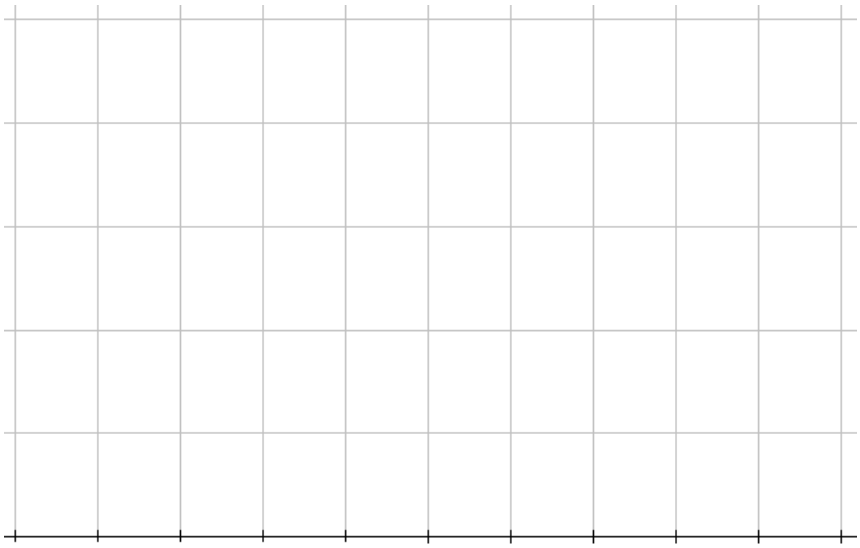
3. A student notices that the bells to mark the start and ends of periods at his school are not very accurate. He accurately records the length of classes over a couple of weeks.

   The mean period length is 55.5 minutes, with a standard deviation of 0.8 minutes.

   a) What is the probability a period will last more than 56 minutes?

   b) Calculate the time the longest 10% of classes will last.

   c) Sketch the distribution:



Answers: L2 Probability Practice #6

1. We could do this with probability trees, but the quicker way is to do it by counting results, which we know must be = 6 × 6 = 36, which is a good check.
Distinguish the individual results: 1_{A1}, 1_{A2}, 2_{A1}, 2_{A2}, 2_{A2}, 3_A and 1_{B1}, 1_{B2}, 2_{B1}, 2_{B2}, 2_{B3}, 3_B

   a) Can only be done by a 2 plus either 1 or 3. P(2 then 1/3) = ½ × ½ = ¼ and P(1 or 3 then 2) = ½ × ½ = ¼. So probability of odd total = **0.5**

   b) There are 36 possibilities, all equally likely, of which 6 end up adding to five ways are = $2_{A1} + 3_{B1}$; $2_{A2} + 3_{B2}$; $2_{A2} + 3_{B3}$; $3_A + 2_{B1}$; $3_A + 2_{B2}$; $3_A + 2_{B3}$
   so P(total = 5) = 6/36 **= 0.1667**

   c) There are 13 ways to get a total of 4. ($1_{A1}+3_B$; $1_{A2}+3_B$; 3_A+1_{B1}; 3_A+1_{B2}; $2_{A1}+2_{B1}$; $2_{A1}+2_{B2}$; $2_{A1}+2_{B3}$; $2_{A2}+2_{B1}$; $2_{A2}+2_{B2}$; $2_{A2}+2_{B3}$; $2_{A3}+2_{B1}$; $2_{A3}+2_{B2}$; $2_{A3}+2_{B3}$) . Of those, four have a 3 in them. P(a 3 if total = 4) = 4/13 **= 0.307**

2.

   a) P(2 large) = P(1st is large) × P(2nd is large) = 15/80 × 14/79 = **0.033**

   b) There are 27 red, of which 7 are large. P(large | red) = 7/27 = **0.259**

   c) Ignore colour, as it is not relevant. There are 45 small and 15 large. Use a tree. 60 × 59 equally likely options. Of these 45 × 44 = 1980 are small then small, 45 × 15 = 675 are small then large and 15 × 45 = 675 are large then small and 15 × 14 = 210 are both large. Take 2L option out of LL, SL and LS options.
   P(both large if one is) = 210 ÷ (210 + 675 + 765) = **0.094**

3.

   a) Graphics: Ncd: lower =56, upper = 99999, σ = 55.5, μ = 0.8
   P(t > 56) = **0.266**

   b) Graphics: InvN: tail =right, area = 0.1, σ = 55.5, μ = 0.8
   (With old Graphics: InvN: tail =left, area = 0.9 and then 0.75, σ = 55.5, μ = 0.8)
   Longest 10% = **over 56.5 minutes**

   c) The sketch must be symmetrical. The peak must be at 55.5 (but can be any height). The curve must be bottoming out more or less around ±2σ (53.9 and 57.1) and must be basically zero by ±4σ (52.3 and 58.7)