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Statistical Methods for CS

Weekly Questions Week 2

Q1 (a) Since there are 6 possibilities for each die roll and the 3 rolls are independent, there are $6^3 = \boxed{216}$ possibilities.

(b) At least one 2?

I will find the number of outcomes containing no 2's and minus this from the total number of outcomes → 216.

How many contain no 2's?
Only 5 outcomes on the die roll will suffice (1, 2, 4, 5, 6) and there are 3 rolls.

$$5^3 = 125$$

$216 - 125 = 91$ possible outcomes containing at least one 2.

91 out of total 216:

$$\Rightarrow \frac{91}{216} = \boxed{0.4213}$$

(c) total = 6^3;
noTwos = 5^3;
ALOneTwo = total - noTwos;
ALOneTwoProb = ALOneTwo / total;

(d) In order to get 17 from 3 die rolls, the outcomes must be two 6's and one 5. This is the only way to get 17 as the highest number on the dice is 6.

As there are 3 die rolls and each dice could give a 5 with the other two giving a 6, there are 3 ways in which 17 can be the result: ① 5,6,6
② 6,5,6
③ 6,6,5

Since, the total possibilities = $6^3 = 216$

$\Rightarrow \frac{3}{216} = \boxed{0.014}$

(c) Since the first dice roll is a 1, then the second and third dice rolls must add up to 11.

The only two outcomes that add up to 11 are 5 and 6.

Since the first roll is a given 1, we are only concerned with the 2nd and 3rd rolls.
There are a total of $6^2 = 36$ possible rolls.

There are 2 ways to roll an 11

$$\Rightarrow \frac{2}{36} = \boxed{0.0556}$$

Q2 (a) There are 2 possibilities of getting 5 on the second throw:

① Roll 1 on first throw and then roll another 6-sided die and get a 5.

$$\Rightarrow \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

② Roll any number except 1 on first roll (5 numbers) and then roll a 20-sided die and get a 5.

$$\Rightarrow \frac{5}{6} \times \frac{1}{20} = \frac{1}{24}$$

Add these two probabilities to get answer:

$$\frac{1}{36} + \frac{1}{24} = \frac{5}{72} = \boxed{0.0694}$$

(b) To get a 15 on the second throw, a 20-sided die must be rolled.
Therefore any number except 1 (2,3,4,5,6) must be rolled on first throw and then 15 must be rolled on second throw.

$$\Rightarrow \frac{5}{6} \times \frac{1}{20} = \frac{1}{24} = \boxed{0.0417}$$

(Q3) Baye's Rule:

$$P(E|F) = \frac{P(F|E)\,P(E)}{P(F)}$$

~~Event F = inspector is 60% convinced~~
How certain should the inspector be when the suspect has the characteristic?

Event E = certainty of inspector (cert)

Event F = suspect has characteristic (hasChar)

$$P(cert|hasChar) = \frac{P(hasChar|cert)\,P(cert)}{P(F)}$$

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