Problem Statement 1: [50 marks]

a) $X \sim Bin(6, 0.3)$, therefore the probability is given by

$$P(X = 2) = \binom{n}{x} * p^x * (1-p)^{n-x}$$

$$= \binom{6}{2} * 0.3^2 * (1-0.3)^{6-2}$$

$$= 15 * 0.09 * 0.2401 = \mathbf{0.324135}$$

b) The average value is given by $E(X) = n\,p = 6 * 0.3 = \mathbf{1.8}$

c) The standard deviation associated with it is given by $s = \sqrt{Var(X)} = n\,p(1-p)$

$$= \sqrt{6 * 0.3 * (1-0.3)}$$

$$= \sqrt{1.8 * 0.7} = \mathbf{1.122}\ (to\ 3dp)$$

Problem Statement 2: [50 marks]

a) $G \sim Bin(8, 0.75)$, therefore the probability is given by

$$P(G\ will\ get\ 5\ correct) = \binom{8}{5} * p^x * (1-p)^{n-x}$$

$$= \binom{8}{5} * 0.75^5 * (1-0.3)^{8-5}$$

$$= \mathbf{0.2076}$$

a) $B \sim Bin(12, 0.45)$, therefore the probability is given by

$$P(B\ will\ get\ 5\ correct) = \binom{12}{5} * p^x * (1-p)^{n-x}$$

$$= \binom{12}{5} * 0.45^5 * (1-0.45)^{12-5}$$

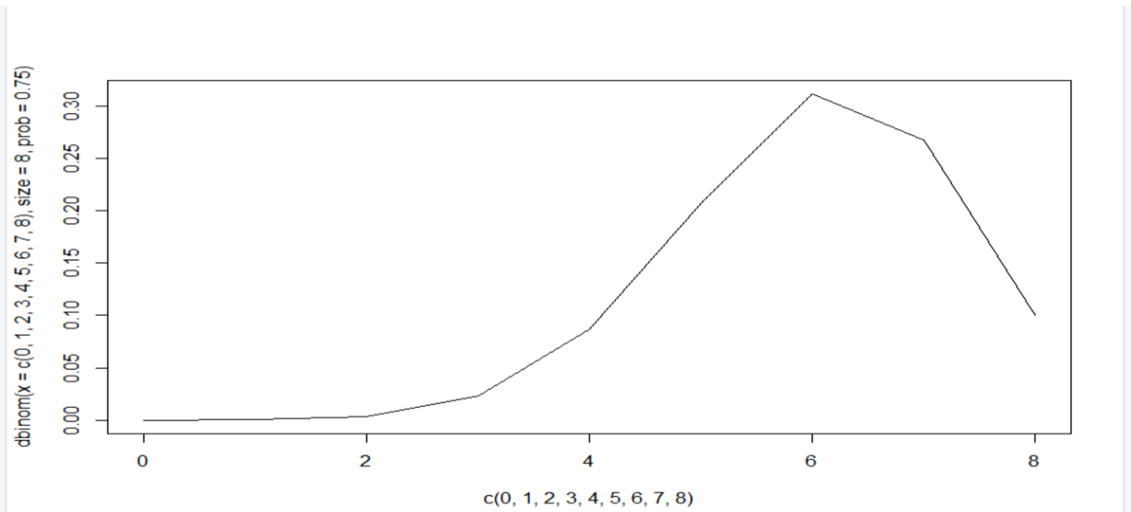
$$= \mathbf{0.2224}$$

In cases of 4 and 6 probabilities of getting 6 correct is much higher than that of getting 4 correct

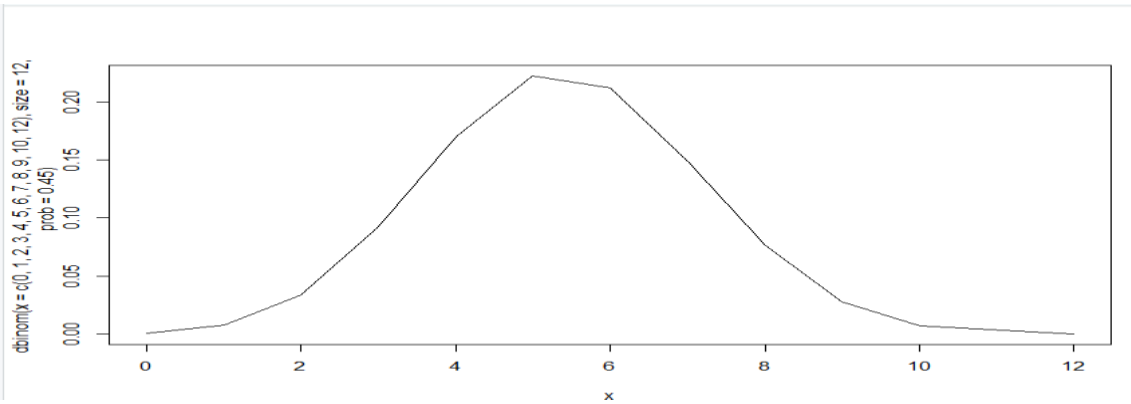
- Number of trials
- Probability of correction

Pictorial View

$G \sim Bin(8, 0.75)$



$B \sim Bin(12, 0.45)$



Problem Statement 3: [100 marks]

$\mu = \left(\frac{72}{60}\right) * 4 = 4.8$, thus $X \sim Po(4.8)$

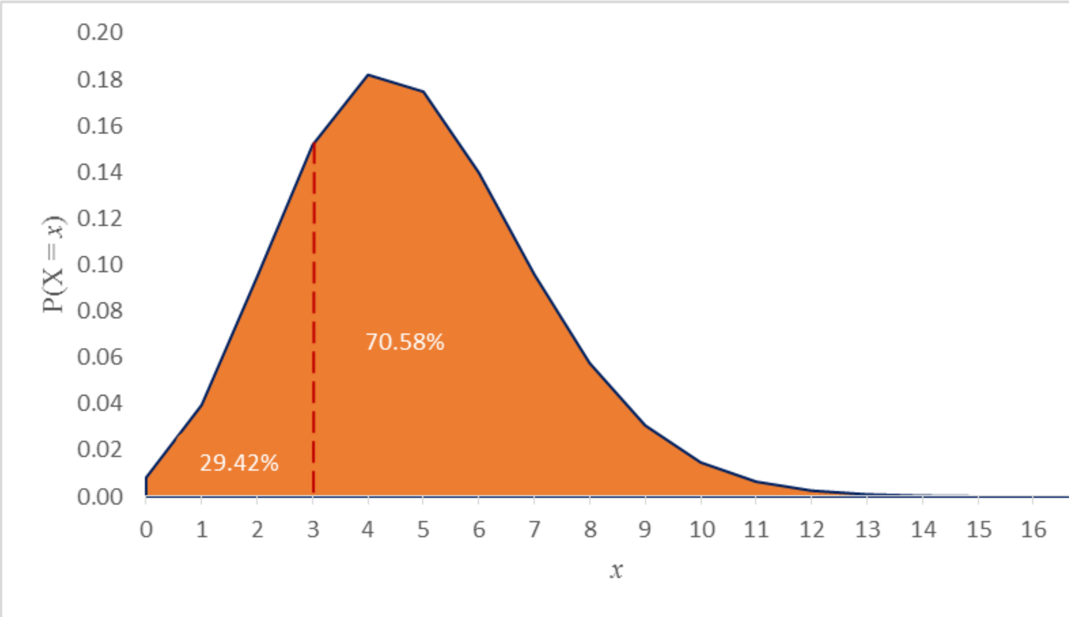
a) $P(X = 5) = \frac{e^{-\mu} * \mu^x}{x!} = \frac{e^{-4.8} * 4.8^5}{5!} = \mathbf{0.1747}$

b) $P(X \leq 3) = P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3)$

$= \frac{e^{-4.8} * 4.8^0}{0!} + \frac{e^{-4.8} * 4.8^1}{1!} + \frac{e^{-4.8} * 4.8^2}{2!} + \frac{e^{-4.8} * 4.8^3}{3!} = \mathbf{0.2942}$

c) $P(X > 3) = 1 - P(X \leq 3) = 1 - 0.2942 = \mathbf{0.7058}$

d) The pictorial view of this is given by



Problem Statement 4: [100 marks]

$X \sim Po(6)$

a) For a 455 word document, the error rate becomes lower i.e. $\mu = \frac{455}{4260} * 6 = 0.591$, thus $X \sim Po(0.591)$

$$P(X=2) = \frac{e^{-0.591} * 0.591^2}{2!} = \mathbf{0.0964}$$

b) For a 1000 word document, the error rate becomes $\mu = \frac{1000}{4260} * 6 = \frac{100}{77} = 1.299$, thus $X \sim Po(1.299)$

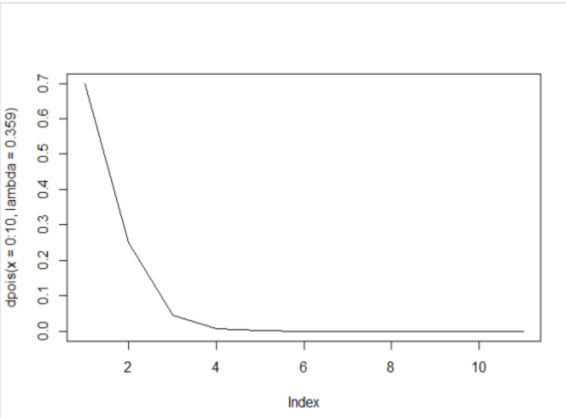
$$P(X=2) = \frac{e^{-1.299} * \ 1.299^2}{2!} = \ \mathbf{0.2301}$$

c) For a 255 word document, the error rate becomes $\mu = \frac{255}{4260} * 6 = 0.359$, thus $X \sim Po(0.359)$

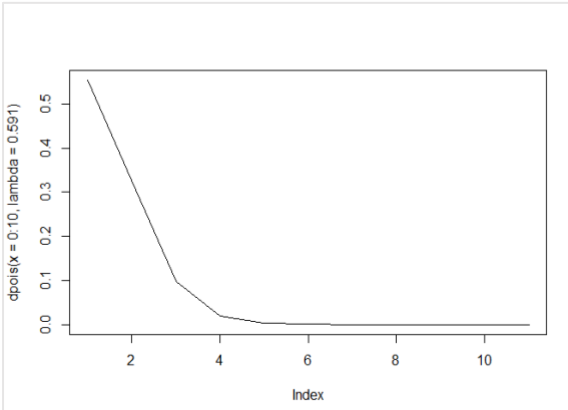
$$P(X=2) = \frac{e^{-0.359} * \ 0.359^2}{2!} = \ \mathbf{0.045}$$

The likelihood of making 2 errors increases as the number of words increases and decreases as the number of words in a document decreases.

255 Words



455 Words



1000 Words