AI1103 Assignment-1

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Download all python codes from

```
https://github.com/CS20BTECH11062/AI1103/tree/
    main/Assignment−1/codes
```

and latex-tikz codes from

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https://github.com/CS20BTECH11062/AI1103/tree/
    main/Assignment−1/Assignment−1.tex
```

QUESTION(Prob 1.4)

Suppose that 90 % of people are right handed. What is the probability that at most 6 of a random sample of 10 people are right handed?

SOLUTION

One can either be 'right' handed or 'left' handed. Given that 90 % of the population is 'right' handed and since being 'right' handed and being 'left' handed are mutually exclusive,

- Probability of 'right' handed = $\Pr(R) = \frac{9}{10}$
- Probability of 'left' handed = $\Pr(L) = \frac{1}{10}$

One can use binomial distribution to find out the probability that more that 6 people are 'right' handed.
Let M be a variable representing number of people who are 'right' handed in a given sample. Picking different number of people is an example of a Bernoulli trial.
So M has a binomial distribution :

$$\Pr(M = k) = \binom{n}{k} * (l)^{n-k} * (r)^{k} \tag{0.0.1}$$

Where

- n = Total number of people = 10
- l = Probability that a person is 'left' handed = $\frac{1}{10}$
- r = Probability that a person is 'right' handed = $\frac{9}{10}$

So,

$$\Pr(M = k) = \binom{n}{k} * \left(\frac{1}{10}\right)^{n-k} * \left(\frac{1}{10}\right)^{k} \tag{0.0.2}$$

Pr(at most 6 are right handed) = $\Pr(M \leq 6)$
$\implies$ 1 - $\Pr(M \geq 7)$
Since

$$\sum_{M=1}^{10} Pr(M) = 1 \tag{0.0.3}$$

Thus, we can write:

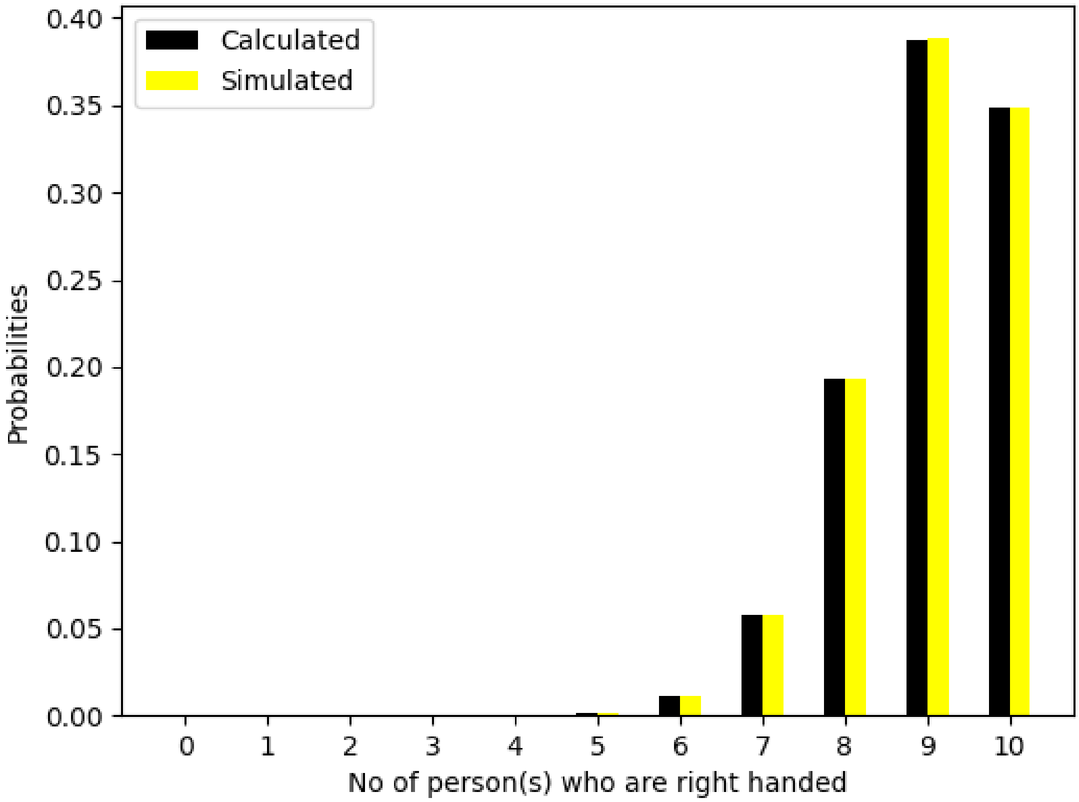
$$1 - \Pr(M \geq 7) = 1 - \sum_{M=7}^{10} \Pr(M) \tag{0.0.4}$$

$$\implies 1 - \sum_{k=7}^{10} \binom{10}{k} * 0.1^{10-k} * 0.9^{k} \tag{0.0.5}$$

$$\implies 1 - \binom{10}{7} * 0.1^{3} * 0.9^{7} - \binom{10}{8} * 0.1^{2} * 0.9^{8} - \binom{10}{9} * 0.1^{1} * 0.9^{9} - \binom{10}{10} * 0.1^{0} * 0.9^{10} \tag{0.0.6}$$

$$\implies \Pr(M \leq 6) = 0.012795198$$

Thus the probability that at most 6 people are 'right' handed out of a random sample of 10 is 0.012795198


Calculated
Simulated
Probabilities
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
1
2
3
4
5
6
7
8
9
10
No of person(s) who are right handed