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 :

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

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,

$$\Pr(M = k) = \binom{n}{k} \times \left(\frac{1}{10}\right)^{n-k} \times \left(\frac{9}{10}\right)^k \tag{0.0.2}$$

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

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

Thus, we can write:

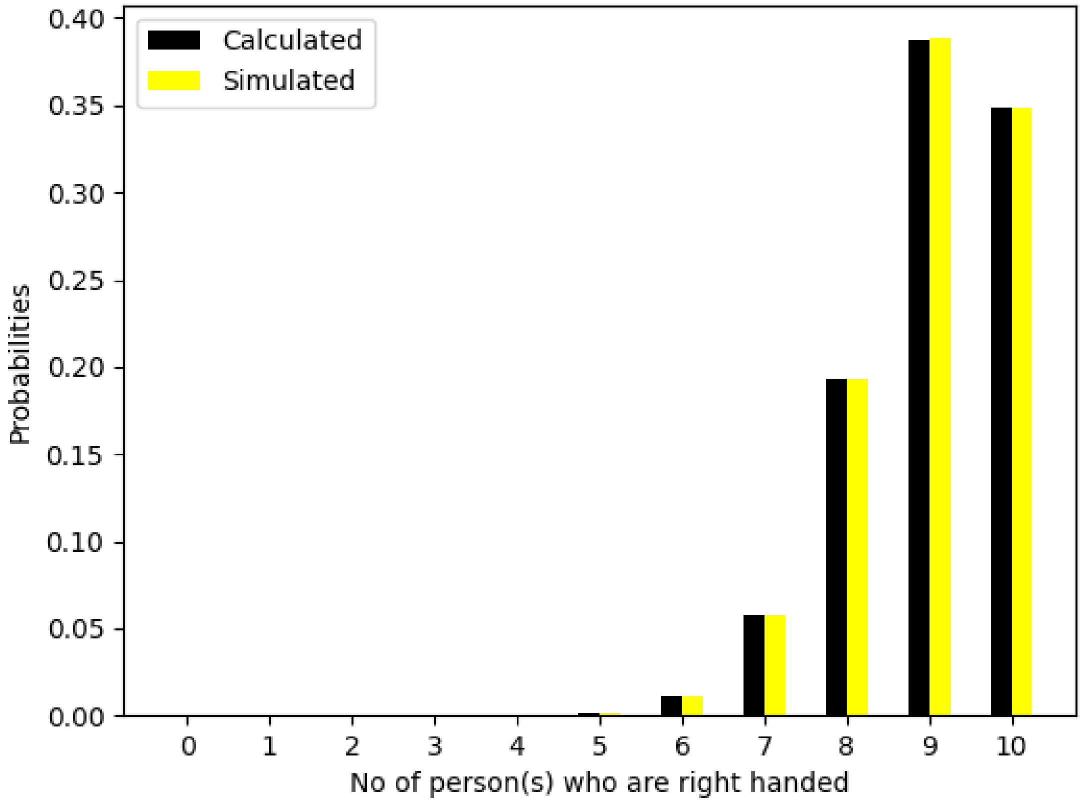
$$1 - \Pr(M \ge 7) = 1 - \sum_{k=7}^{10} \Pr(M = k) \tag{0.0.4}$$

$$\implies 1 - \sum_{k=7}^{10} \binom{10}{k} \times \left(\frac{1}{10}\right)^{10-k} \times \left(\frac{9}{10}\right)^k \tag{0.0.5}$$

$$\implies 1 - \binom{10}{7} \times \left(\frac{1}{10}\right)^3 \times \left(\frac{9}{10}\right)^7 - \binom{10}{8} \times \left(\frac{1}{10}\right)^2 \times \left(\frac{9}{10}\right)^8 - \binom{10}{9} \times \left(\frac{1}{10}\right)^1 \times \left(\frac{9}{10}\right)^9 - \binom{10}{10} \times \left(\frac{1}{10}\right)^0 \times \left(\frac{9}{10}\right)^{10} \tag{0.0.6}$$

$$\implies \Pr(M \le 6) = \frac{7996999}{625000000} \tag{0.0.7}$$

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