Question 1

- a) In GSM-900 network.
  - Find the frequency reuse ratio D/R;

    > The frequency reuse ratio $\frac{D}{R}$ Could be calculated by the equation : $\frac{D}{R} = \sqrt{3N}$.
    >
    > By checking the reference, the number of cells in the GSM-900 system is **4**.
    >
    > So, the D/R is :
    >
    > $$\frac{D}{R} = \sqrt{3 \times 4} \approx 3.46$$

  - Find the carrier to interference ratio C/I in dB if an omnidirectional antenna is used;

    > 9 dB

  - Find the carrier to interference ratio C/I in dB if three 120 degree directional antennas are used;

    > 24.5 dB

  - If 496 channels are allocated to this cellular network, given a GOS 2%, using Erlang B Table to find out the traffic intensity being supported in each cell in ii) and iii), respectively.

    > - for cell in ii)
    >
    >   > 486.4 Erlang
    >
    > - For cell in iii)
    >
    >   > 152.0 Erlang

- b) Assume a cell receives on average 360 calls per hour, the mean holding time of a call is 120 seconds and the grade of service is 0.02. Using Erlang B Table, answer the following questions.
  - Calculate the offered traffic in the cell.

    > The offered traffic intensity is :
    >
    > $$T = \frac{360 \times 120}{3600} = 12\ Erlang$$

  - How many channels are needed in this cell if an omnidirectional antenna is used?

    > By checking at Erlang Table for a GOS of 0.02. It is found that **19** channels are required for an offered traffic of 12 Erlang.

  - Considering the offered traffic is uniformly distributed inside the cell, how many channels does the cell need if three 120 degree directional antennas are used?

    > Each sector can receive traffic of $12/3 = 4\ Erlang$;
    >
    > The required channel in the sector is 9;
    >
    > Total channels need is $3 \times 9 = 27$;

- Compare and comment on the channel utilization efficiency in sub-questions ii and iii.

> The trunking efficiency is :
>
> $$\frac{19}{27} = 0.704$$