1. **In queuing model described by M/M/1, explain what these parameters stand for.**

That means that the system has a Poisson arrival process, an exponential service time distribution, and one server.

2. **Show the main difference between the fundamental assumptions of Erlang first**

**Formula (B-Formula) and the Erlang Second formula (C-Formula).**

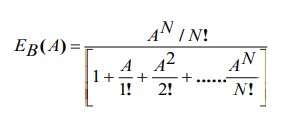
Erlang first Formula (B-Formula):

a- Calls occur individually and collectively at random, i.e., in accordance with Poisson distribution (this implies a very large no of calling sources).

b- A state of statistical equilibriums exists.

c- Calls originating when all trunks are being busy are lost, and their holding time is Zero.

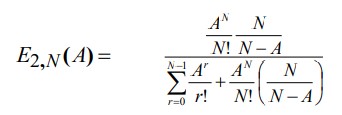
d- Negative exponential holding time is assumed.

Probability of blocking at the switch due to congestion or “all trunks (links) busy”:

Erlang second Formula (C-Formula):

The same assumptions of lost call system are still valid except (c) which is replaced by:

- Calls originating when all trunks are busy, wait for service as long as necessary, and are connected immediately when a trunk becomes free.

Blocking probability will be given by:

3. **A small community with 400 subscribers is to be served with a remote switch.**

**Assume that the average subscriber originates 0.15 Erlang of traffic. Also**

**assume that 30 % of the origination are local (intra-community) calls and that**

**70% are transit calls to the serving central exchange.**

**(a) How many Erlangs of traffic are offered to the central exchange?**

400 \* 0.15 \* 70% = 42

**(b) How many trunk lines are needed for 1% blocking of the transit traffic?**

From the table at B=2%, nearest load is 55

4**. Four clusters of data terminals are to be connected to a computer by way of**

**leased circuits. The traffic from each cluster used separate group of shared circuits.**

(a) **Assume that 25 terminals are in each cluster and each terminal is active**

**25% of the time. Determine the number of circuits required for each**

**cluster assuming that the maximum desired blocking probability is 2%.**

**Find the total number of circuits.**

Total traffic per cluster A =25\*0.25=6.25 E

at B=2%, the nearest load is 6.61 E, no. of circuits is 12 Circuits

**(b) What would happen if the traffic intensity is doubled?**

If the traffic intensity is doubled, 2\*6.25 = 12.5 E

at B=2%, N= 19 E

**(c) Repeat (a) and (b) if the traffic from all clusters is connected onto one**

**group of circuits?**

**All terminals are in one cluster.**

1. A= 4\*25\*0.25=25 E, N=34 circuits
2. A= 4\*25=50 E, N=61 circuits

**(d) What do you conclude from the results of these two different network configurations?**

**From these results.**

Doubling the traffic does not mean doubling the number of circuits because the relation is not linear.

In case of 4 separate clusters, each cluster requires 12 circuits, while in case of all terminals in one cluster, the no. of required circuits is less, 34 instead of 4\*12.

So, the utilization of circuits is better. But in case of a link failure, all terminals will be disconnected, while in 4 cluster configurations, only part of terminals will be disconnected.

**5. Give examples of the applications that use LEO and MEO satellite systems.**

LEO satellites are commonly used for: Communications, military reconnaissance, spying and other imaging applications.

MEO satellites also require a constellation of satellites to provide geographic coverage.

MEO satellites are commonly used for: positioning information like GPS, GLONASS and Galileo.

**6. Is it possible that terrestrial networks become preferential than communication**

**satellite systems?**

No because each one is used in a specific application.

So, the correct answer is Optical fiber cables provides higher bandwidth, hence high bit rate at low latency (delay).