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Name : Shuvo Biswas
ID : IT-16014

01. (a) Write down the various types of switching in telecommunication engineering.

(b) Write down the difference between time division switching and optical switching.

(c) How does a switching network design?

02. (a) Define a multistage network and fabric switching.

(b) Consider a switch with a 100x100 interconnect function. Find out the total cross points for (i) Full matrix switch and (ii) Folded matrix switch.

(c) For 100 x 100 in 2 stages switch, how many xpts? Also write how does it works?

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03. (a) How can we reduce blocking?

(b) Draw a 16x16 2-stage switch using 4x4 non-blocking full matrices.

(c) Explain linking blocking.

(d) What happens if we want to connect another inlet the 1st block of stage 1 to another outlet of the 3rd block of stage 2?

04. (a) Define call packing. Analyze how blocking in a network occurs?

(b) Write down the difference between TSI and TMSS.

(c) How does a TSI system work?

05. (a) How does a TMSS system work?

(b) Write down the switching technique for data transmission.

(c) Write down the difference between store and forward switching Vs Circuit switching.

06. (a) Define system and subsystem.
(b) How does a time-space-time switch works?
(c) Write down the layering principles.
(d) Briefly describe various types of layring systems.

07. (a) Define LAN with examples.
(b) Write down the advantages and disadvantages of LAN.
(c) Write down the difference between LAN and MAN.
(d) Define fibre optic networks with ~~wit~~ its characteristics.

08. (a) Define Random Hunting and Sequential Hunting.
(b) Individual trunks are only economic if they can carry 0.4E or more. A trunk group of size N=10 is offered 6E. will all 10 trunks be economical?
(c) Write down the difference between time congestions vs. Call congestion.

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Answer to the Question NO-01 (a)

Various types of switching in telecommunication engineering. These are given below:↓

Circuit Switching:↓

↳A path is established between the caller and destination
↳ Real-time connection formed
↳ Example: PSTN.

Message Switching:↓

↳ Also called store and forward
↳ A message is first stored in a buffer and then sent on its entirety step by step.
↳ No real-time connection
↳ Example: E-mail

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Packet Switching :

↳ A message is broken down into parts and each part is sent separately.

↳ Example : Internet UDP protocol

Space Division Switching :

↳ Connecting two channels that are separated in space

↳ Can be mechanical or electronic

↳ Several problems

* Slow
* Bulky with lots of inter-connect wiring
* Subject to cross-talk

Strowger Switching :

↳ patented 12/march/1889

↳ First widely-used alternatic exchange system.

↳ A wiper assembly moves across a fixed set of switch contacts.

↳ Two uni-selectors can be wired back-to-back.

Crossbar Switching:

↳ The Crossbar switching became popular in the 1940's and is still used in some places today.

↳ Uses a simple rectangular matrix.

↳ Actuators are operated at incoming circuits and outgoing circuits to make metalic contact.

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Answer to Question No-01 (b)

Difference between Time division switching and Optical switching:

Time division Switching:

↳ In digital TDM systems, channels ~~and~~ do are divided by time slot but switching is still possible.

↳ Switching is by a time-slot interchanger and is accomplished by rearranging the order in which data is read out of the buffer.

↳ Incoming data enters a speech store while the outgoing channels to the speech address memory which incoming time-slot it is assigned to.

↳ During each time-slot, the outgoing circuit reads the speech store slot corresponding to the SAM.

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Optical Switching:

↳ One wavelength can be turned into another

↳ Also called wavelength conversion

↳ Important in reducing blocking due to wevelength contention in routing and wavelength assignment.

↳ Opto electronic conversion consists of optical receiver, conversion to electronic signal.

Answer to Question No-01 (c)

Switching Network Design:

Several points to Consider:

↳ Blocking versus non-blocking switches

↳ Numbers of cross-points

↳ Reliability

↳ Overload

↳ Growth

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Trunk switch:

↳ One-to-one connection
↳ One specific inlet conn must connect to one specific outlet

Access Switch:

↳ One-to-any connection
↳ One specific inlet must connect to any free outlet

Answer to the Question No -02 (a)

Multistage network:

A multistage network is a network for interconnecting a set of nodes through a switching fabric.

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Switching fabric:

The switching fabric consists of a set of switches interconnected to form a topology with defined connection points for the nodes.

Answere to the Question No-02(b)

Consider a switch with a 100x100 interconnect function.

(i) For full matrix switch:

Need $100 \times 100 = 10,000$ cross-points

(ii) for Folded matrix switch,

need $\frac{n(n-1)}{2} = \frac{100 \times 99}{2} = 4950$ cross-points.

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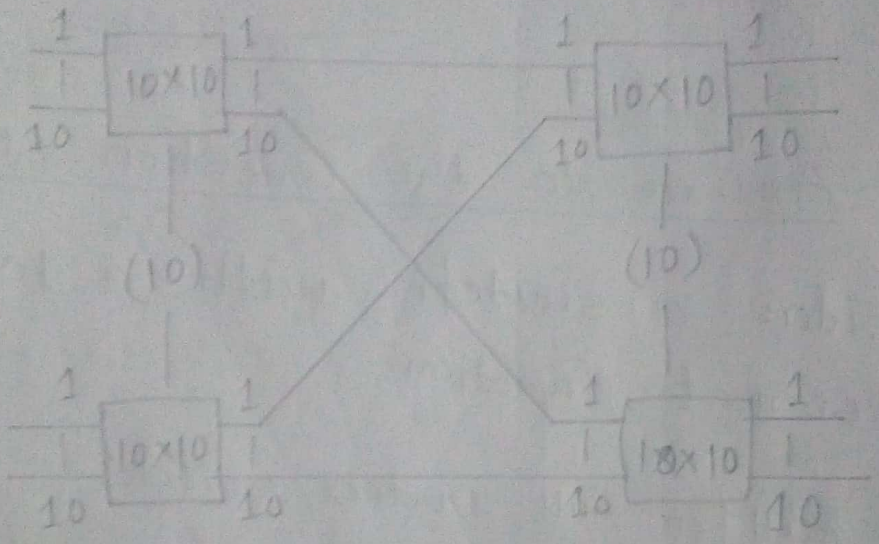
Answere to the Question 02 (C)

Fore the 100 x 100 interconnected function in two stages is given below:↓



Each block is 10x10 = 100 xpts

Each stage is 10 blocks = 1000 xpts

whole switch has 2 stages = 1000 + 1000

= 2000 xpts

How does it work?

↳ Divide the 100 inlets into groups of 10.

↳ 1st outlet of each stage 1 block is connected to an inlet of the 1st stage 2 block.

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↳ 2nd outlet of each stage 1 block is connected to an inlet of the 2 stage 2 block.

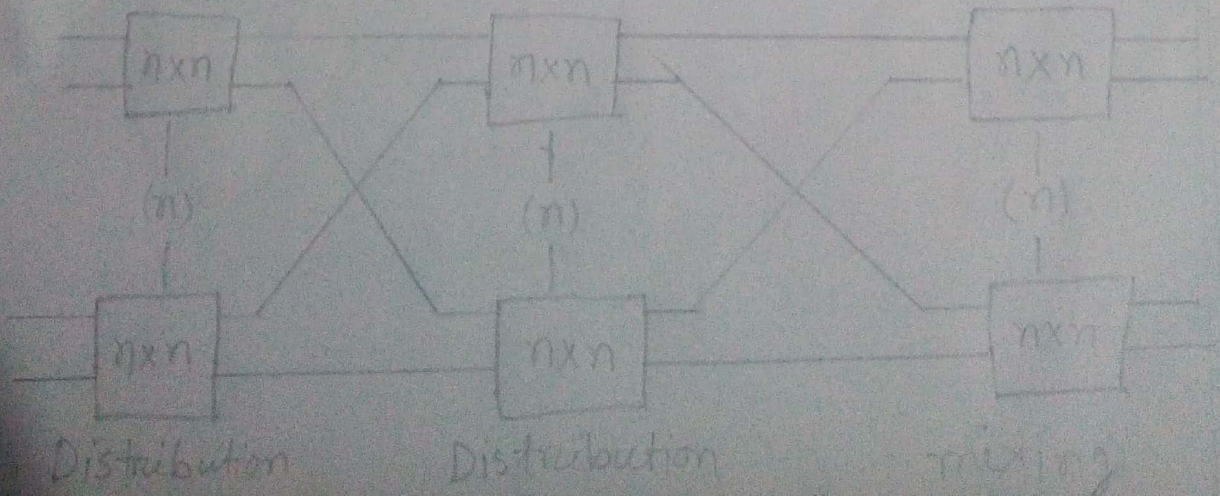
↳ 3rd outlet of each stage 1 block is connected to an inlet of the 3 stage 2 block...

↳ i^{th} outlet of each stage 1 block is connected to an inlet of the i^{th} stage 2 block

Answer to the Question No-03(a)

We need a way of reducing blocking:

The solution is to add a mixing stage that keeps the overall switch size the same but can reduce blocking by adding multiple paths through the switch.



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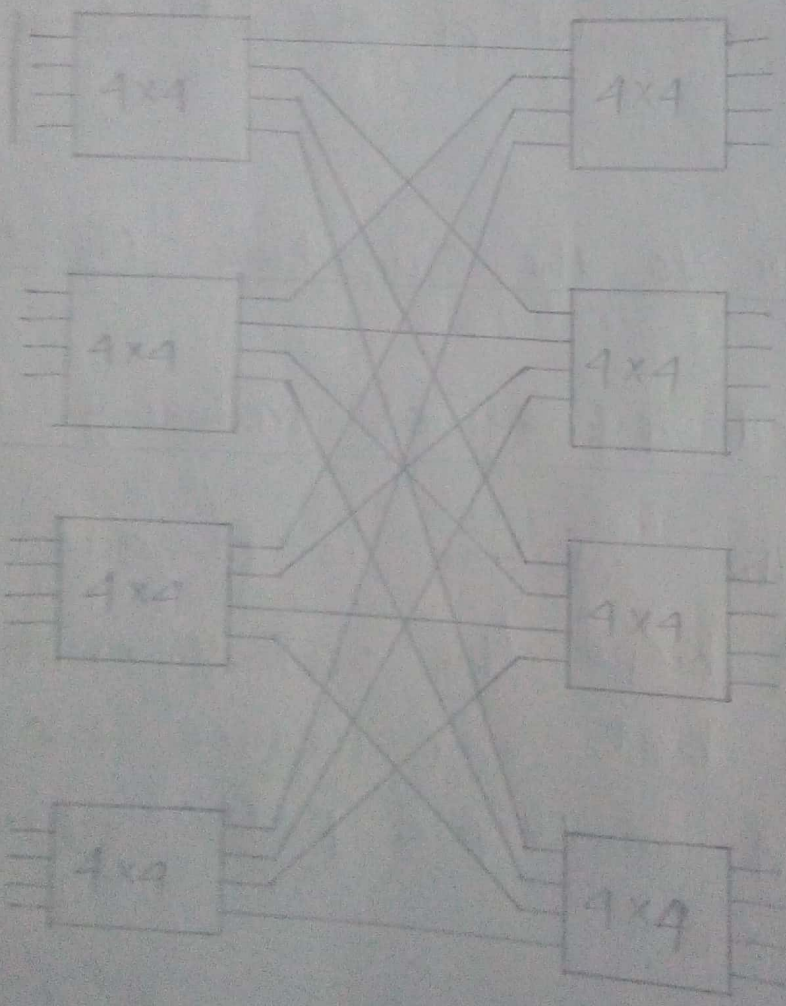
Answer to the Question No-03 (b)

Block diagram of 16x16 2-stage switch using 4x4 non-blocking full matrices: ↓



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Answer to the Question No-03(c)

Linking Blocking:

↳ Because of the single link between each module and the modules in the next stage, there's a possibility of blocking.

↳ Consider an inlet in the 1st block of stage 1 connected to an outlet in the 3rd block of stage 2.

~~Now~~

Answer to the Question No-03(d)

If we want to connect another inlet the 1st block of stage 1 to another outlet of the 3rd block of stage 2.

Then a problem arises because there is only a single route available through a switch with only distribution type of stages.

Even though the entire switch is made up of non-blocking square matrices, we can still encounter blocking.

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Answer to the Question No-01(a)

In a network, the blocking occurs:

↳ There are generally free links in each stage

↳ problem is that they are mismatched from stage to stage.

Call packing:

Call packing is a strategy of organizing new calls so that they use free links corresponding to other busy links in the next stage if possible.

Answer to the Question No-04(b)

Difference between TSI and TMSS:

*** TSI:

↳ TSI stands for time slot interchanger
↳ A TSI is a time switch
↳ Switches one time slot channel in a single physical input to another time slot.
↳ Functionally equivalent to an $n \times n$ space-devided switch where n is the number of time slots.

*** TMSS:

↳ TMSS stands for time multiplexed space switch
↳ A space switch that is potentially reconfigured entirely in every time slot of each frame.
↳ Data is switched such that for each time slot.
↳ Data does not switch time-slots.

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Answer to the Question No-04(c)

A TSI ~~TSI~~ system works:↓

↳ Data is written to the speech store cyclically as it comes in.

↳ path set-up control signalling tells the SAM to store the name of the input time slot in the appropriate location corresponding to the output time slot it must be switched to.

↳ Data is read a-cyclically from the speech store in the orders of the output time slots as stored in the SAM.

Answer to the Question No-05(a)

A TMSS stytem works:

↳ A memory structure called cross-point address memory is used to control switching.

↳ Enterepriese private network (EPN)
↳ passive Optical Local Area Network (POLAN)

Answer to the Question No-5(b)

Switching techniques for data transmission:

The switching techniques for data transmission can be classified into two categories. They are given below:↓

① Circuit Switching Technique
② Store and Forward Technique

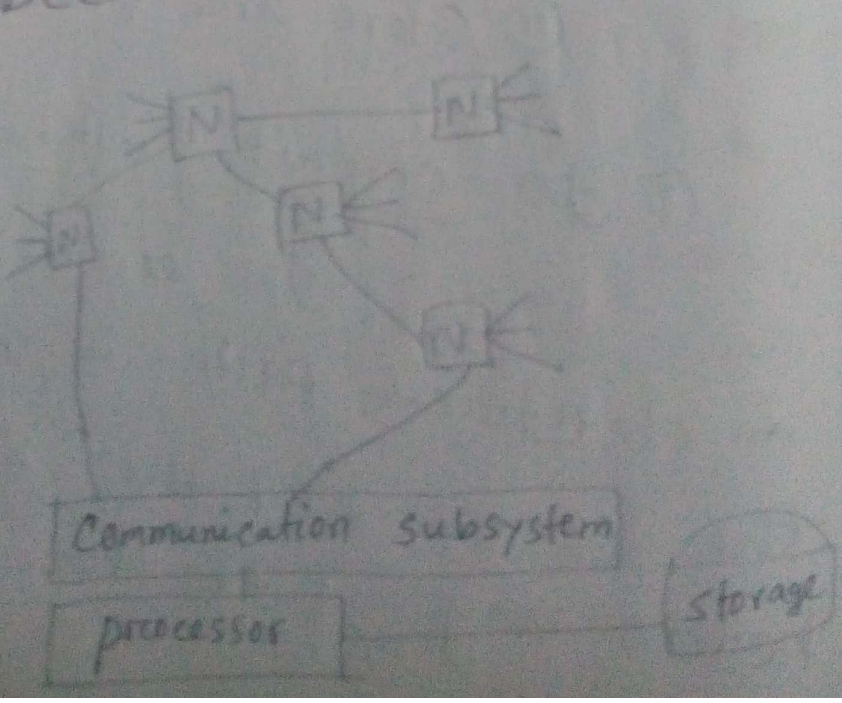
① circuit switching technique:

In circuit switching technique, an electrical path is established between the source and the dst destination before any data transfer takes place.

The electrical path may be realished by physical wires or coaxial cables or ~~dat~~ radio or satellite links.

Store and Forwarad switching:

In store and forward switching network, the switching nodes have the ability to store user messages and forward the same towards the destination as and when the links become available.



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Answer to the Question No-05 (c)

Difference between store and forward switching Vs circuit switching:

Circuit Switching	Store and forward switching
① An electrical path is established between the source and the destination.	① The switching node have the abelity to store user messages and forward the same towards.
② The electrical path may be realised by physical wires.	② Each node is equipped with a processor and some buffer storage.
③ The path selection is based on a routing algorithm.	③ No end-to-end link is set up prior to data transmission.
④ There are three explicit phases involved in circuit switched data transfer.	④ The network moves the user information from node to node.

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Answer to the Question No-06(a)

System:

A system is one or more autonomous computers and their associated software, peripherals and users.

Sub-System:

A logically independent smaller unit of a system.

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↳ Controlling signalling tells the XAM to store the name of the physical input in the appropriate time slot location.

↳ The space switch is rapidly reconfigured at each time slot to affect the proper connections.

Answer to the Question NO-06(b)

A time-space-time switch works:

↳ We find a time slot is free from the input ISI to the TMSS and from the TMSS to the ~~input~~ output ISI we wish to connect to.

↳ Next, switch the input channel's time ~~out~~ slot in question to the free time slot.

↳ Then at the TMSS, connect the proper input line to the proper output line during free time slot.

↳ Finally at output line's ISI, switch the free time slot to the time slot we wish to switch to.

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Answer to the Question No- 06(c)

⊞ The layering principles are given below: ↴

1. Create layers to handle Functions which are manifestly different in the process performed.

2. Collect ~~number~~ similar functions into the same layer and create a boundary at a point where the number of interactions across the boundary are minimised.

3. Create a layer of easily localised functions so that the layer could be totally re designed and its protocals change.

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Answer to the Question No-06(d)

Describe various types of Layers:

~~In OSI mot~~

According to OSI model, there are seven types of layers in network. They are given below:-

(1) physical Layer
(2) Data Link Layer
(3) Network Layer
(4) Transmission Layer
(5) Session Layer
(6) Presentation Layer
(7) Application Layer.

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↳ physical Layer:

↳ This ~~the~~ is the most lowest layer of the OSI model.

It permits the usages of a realistic variety of physical media and control procedures.

↳ Data link Layer:

The data link layer deals with error detection and automatic recover procedures required when a message is lost or corrupted.

↳ Network Layer:

The highest link-to-link layer in the OSI model is the network layer.

↳ It transmits of packets from the source node to the destination node.

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↳ Transport Layer:

Transport layer is the first end-to-end layer in the OSI architecture.

It is responsible for matching user message characteristics and servic requirements.

↳ Session Layer:

The session layer oreganise different sessions between coopercating entities and perform all related functions.

↳ presentation Layer:

The presentation layer represent information to the communicating application entities in a way that preserves the meaning.

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↳ Application Layer:

Application layer is the highest layer in the OSI reference model.

The application layer provides services to the users of OSI environment.

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Answer to the Question No-07(a)

LAN:

LAN stands for local area network. which typifies a distributed environment and finds applications in a number of area.

* Some examples are:
  - ↳ Office automation
  - ↳ Factory automation
  - ↳ Distributed automation
  - ↳ Fire and security systems
  - ↳ process control
  - ↳ Document Distribution

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Answer to the Question No - 07(b)

Advantage and disadvantage of LAN:

** Advantages:

↳ Offers a good back up capability in the event of one or two systems.

↳ provides a resource-sharing environment

↳ permits multivendor systems.

↳ In LAN, the systems are are generally so chosen as to meet most of the user.

↳ Operation time is small.

** Disadvantages:

↳ High setup cost

↳ privacy voi violations

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↳ Date security Thread ..
↳ LAN maintenance Job
↳ Covers Limited area

Answer to the Question No-07 (c)

Difference between LAN and MAN:

LAN	MAN
① LAN stands for local area network.	① MAN stands for metropolitan area network.
② LAN is a group of computers and network devices connected together.	② MAN is a larger network that usually spans several buildings in the same city
③ It has short propagation delay. than MAN	③ It has high propagation delay than LAN.
④ It covers the smallest area.	④ It covers the largest area.

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LAN	MAN
⑤ LAN's ownership is private	⑤ MAN's ownership can be public or private.
⑥ Easy design and maintenance.	⑥ Complex design and maintenance than LAN
⑦ LAN's cost is less than MAN.	⑦ MAN's cost is higher than LAN

Answer to the Question No-07(d)

Fibore Optic:

Fibore optics is the technology used to transmit information as pulse of light through strands of fiber made of glass over long distance.

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Characteristics of Fibore optic networks:

The Optical fibre networks are characterised by

1. High speed opercation
2. Ability to span large distance
3. Ability to support a moderate number of stations.

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Answer to the Question No - 08 (a)

Random Hunting :-

Increase in trunk group's total carried traffic after adding an N^{th} trunk.

Sequential Hunting :-

Actual traffic carried by the N^{th} trunk in the group.

Answer to the Question No - 08 (b)

Given that,

$N = 10$ and $A = 6E$

$\therefore A_N = A(B(N-1, A) - B(N, A))$

$\Rightarrow A_{10} = 6(B(10-1, 6) - B(10, 6))$

$= 6(B(9, 6) - B(10, 6))$

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$$\sum_{i=0}^{N} \frac{A^i}{i!} = 1 + A + \frac{A^2}{2!} + \frac{A^3}{3!} + \cdots \frac{AN}{N!}$$

$$\therefore \sum_{i=0}^{9} \frac{6^i}{i!} = 1 + 6 + \frac{6^2}{2!} + \frac{6^3}{3!} + \frac{6^4}{4!} + \frac{6^5}{5!} + \frac{6^6}{6!} + \frac{6^7}{7!} + \frac{6^8}{8!} + \frac{6^9}{9!}$$

$$= 7 + 18 + 36 + 54 + 64.8 + 64.8 + 55.54 + 41.66 + 27.77$$

$$= 369.57$$

$$\therefore B(9,6) = \frac{A^N}{N!} \Big/ \sum_{i=0}^{N} \frac{A^i}{i!}$$

$$= \left(\frac{6^9}{9!}\right) \Big/ \left(\sum_{i=0}^{9} \frac{6^i}{i!}\right)$$

$$= 27.77 / 369.57$$

$$= 0.07514$$

and $B(10,6) = \left(\frac{6^{10}}{10!}\right) \Big/ \left(\sum_{i=0}^{10} \frac{6^i}{i!}\right)$

$$= 16.66 / \left(\sum_{i=0}^{9} \frac{6^i}{i!} + \frac{6^{10}}{10!}\right)$$

$$= 16.66 / (369.57 + 16.66)$$

$$= 0.04314$$

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$\therefore A_{10} = 6(B(9,6) - B(10,6))$

$= 6(0.07514 - 0.04314)$

$= 6 \times 0.032$

$= 0.192E < 0.4E$

So, at least the 10th trunk is not economical.

Answer to the Question No-08 (c)

Difference between time congestions vs call congestion.

* **Time Congestion:**
  - ↳ proportion of time a system is congested
  - ↳ probability of blocking from point of view of servers.
  - ↳ for time congestion,

$$P(B) = P(K \geq N)$$

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** Call congestion:

↳ probability that an arriving call is blocked

↳ probability of blocking from point of view of calls.

↳ for call congestion,

$$P(B) = P(K > N)$$