Final Assessment│Fall 2022

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CSE- 21st Batch

Computer Networks

Code: CSE- 323│**ID:** 2121210071

Answer to the Question no. 1

Let us assume bandwidth of each arrival of A1 is 3kbps and that of A2 is 4kbps, then probability state will be with the condition: D1x1+D2x2<=15. Determine Qos of each traffic

Possible Probability States

3	$A^3_1/3!$	(0,3)	
2	$A^2_1/2!$	(0,2)	
1	A1	(0,1)	(1,1)
0	1	(0,0)	(1,0)
A1=1		1	A2
A2=2		0	1

Possible Probability States

3	$A^3_1/3!$	$A^3_1/3!$	
2	$A^2_1/2!$	$A^2_1/2!$	
1	A1	A2A1	$A^2_2/2!$
0	1	A2	$A^2_2/2!$
		1	A2
		0	1

Possible Probability State before normalization

3	0.167	0.334	
2	0.5	1	
1	1	2	2
0	1	2	2
		1	2
		0	1

(Qos of each traffic is 12.001)

Answer to the Question no. 2 (a)

Call Origination

Call origination is an incoming call received by your phone service provider and routed to your business phone system.

In cloud phone systems, voice over IP (VoIP) technology uses session initiation protocol (SIP) to digitize voice data and send it to the recipient. Therefore, call origination is the process of collecting calls initiated by a calling party (your customers) over a telephone exchange or PSTN and then handing the calls over to a VoIP endpoint.

Call origination, also known as voice origination, refers to the collecting of the calls initiated by a calling party on a telephone exchange of the PSTN, and handing off the calls to a VoIP endpoint or to another exchange or telephone company for completion to a called party.

Handover Call

In cellular telecommunications, handover, or handoff, is the process of transferring an ongoing call or data session from one channel connected to the core network to another channel. In satellite communications it is the process of transferring satellite control responsibility from one earth station to another without loss or interruption of service.

- When a call is in process, the changes in location need special processing
- Within a BSS, the BSC, which knows the current radio link configuration (including feedbacks from the MS), prepares an available channel in the new BTS
- The MS is told to switch over to the new BTS
- This is called a hard handoff (In a soft handoff, the MS is connected to two BTSes simultaneously

Answer to the Question no. 2 (b)

Network Performance Measurement:

- Two Performance Measures
  - Quantity of Service (Throughput)
    - How much data travels across the net
    - How long does it take to transfer long files
  - Quality of Service (Average packet delay)
    - How long does it take for a packet to arrive at its destination
    - How responsive is the system to user commands
    - Can the network support real-time delivery such as audio and video?

Types of Routing Algorithms:

- Nonadaptive (static)
  - Do not use measurements of current conditions
  - Static routes are downloaded at boot time
- Adaptive Algorithms
  - Change routes dynamically
    - Gather information at runtime
      - locally
      - from adjacent routers
      - from all other routers
    - Change routes
      - Every delta T seconds
      - When load changes
      - When topology changes

Answer to the Question no. 4 (a)

Traffic intensity/user = $\lambda.t_h$

= 1x(1/60)x2.5

= 0.041 Erl/user

For each cell, n = 20, B = 10%

From Erlang's table, The offered traffic, A = 17.61 Erls.

Number of users/cell = 17.61/0.041 = 429

Total number of users = 700×429 = 300300

Penetration rate = (Number of users/Total population) ×100

= $(300300/4\times10^6)$ 100

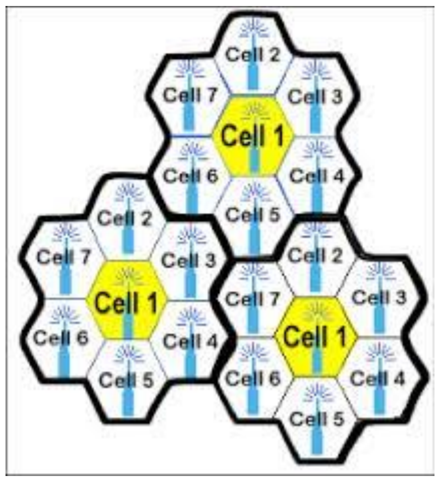
= 7.50% (Answer)

Answer to the Question no. 4 (b)

Frequency Reuse

The concept of frequency reuse is based on assigning to each cell a group of radio channels used within a small geographic area.

1. Cells are assigned a group of channels that is completely different from neighboring cells
2. The coverage area of cells is called the footprint and is limited by a boundary so that the same group of channels can be used in cells that are far enough apart.
3. Cells with the same number have the same set of frequencies.



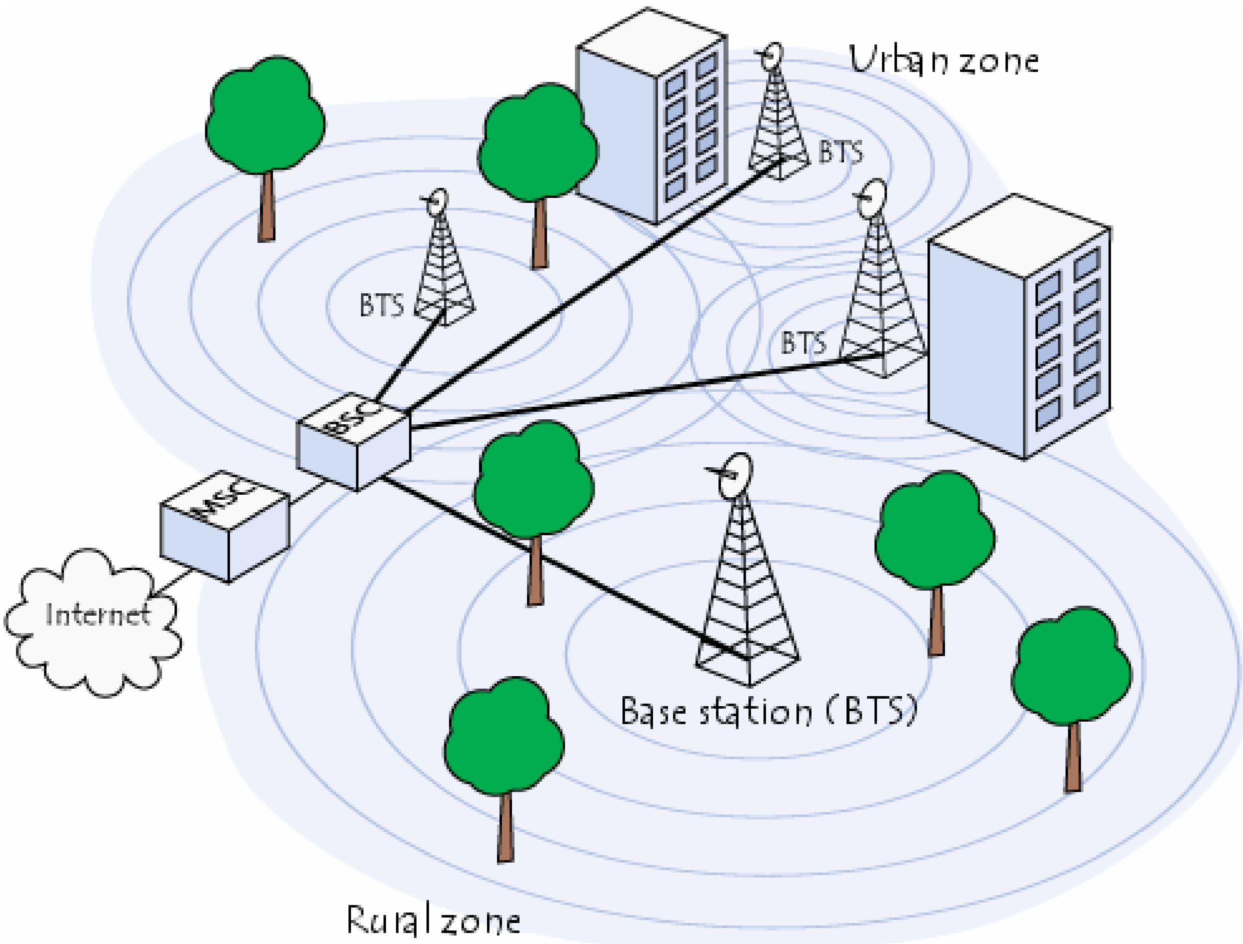
Frequency Reuse Example ··

What would be the minimum distance between the centers of two cells with the same band of frequencies if cell radius is 1 km and the reuse factor is 12?

D/R = √3N

D= (3×12)1/2 x 1 km = 6 km

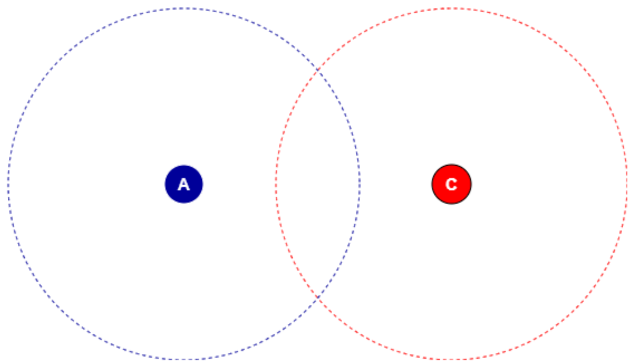
Cellular Network:



Answer to the Question no- 5 (a)

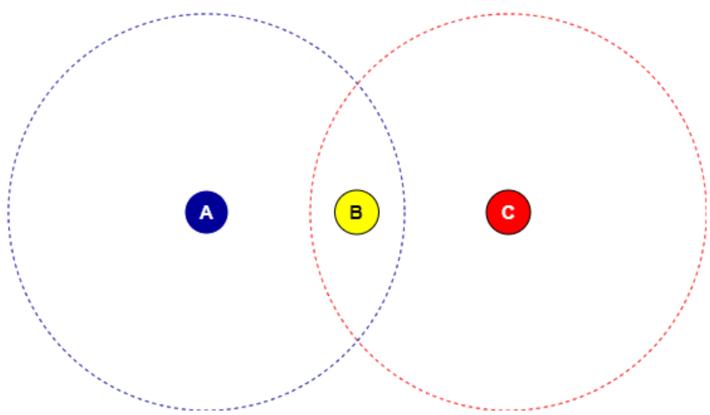
Hidden terminal problem:

The hidden terminal problem, also known as the hidden station and hidden node problem, occurs when two or more nodes that aren't in each other's coverage area simultaneously transmit data to a common node. An example of this phenomenon is illustrated below:



The diagram above shows two nodes, A and C, whose respective coverage areas are represented by the dotted circles. It can be seen that neither of the nodes is in the other's coverage area and thus is unaware of the other's existence.

This arrangement, however, becomes problematic when a third node is introduced inside the area of intersection of the two nodes, as shown below:



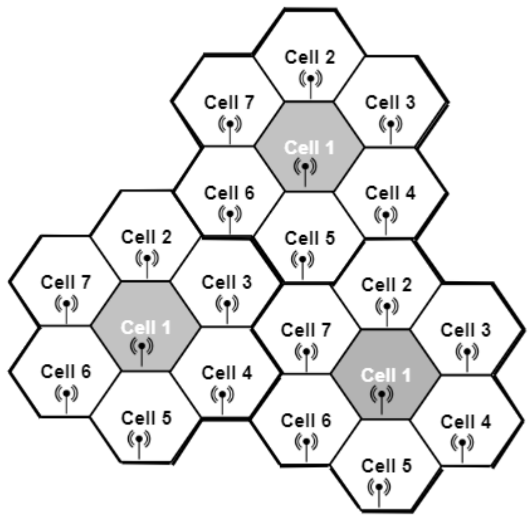
As we can see, since neither node A nor node C is aware of the other's existence, they transmit data to nearby nodes, including B, independently of the other's decision. If node B receives data from both A and C at the same time, a collision occurs, and the received data is discarded.

<u>Answer to the Question no- 5 (b)</u>

Cell Cluster:

When planning a cellular network, operators typically allocate different frequency bands or channels to adjacent cells so that interference is reduced even when the coverage areas overlap slightly. In this way, cells can be grouped together in what is termed a cluster.

Cell cluster of 7 frequency reuse:



All cells marked as 'Cell 1' will be allotted the same group of channels. i.e. cells which have been given the same number in the diagram have the same group of channels. Cells which have been allotted the same group of frequency channels are called *Co-channel cells*. Cells 1-Cell 7 have unique channels and there are no repetitions. Group of cells in which every channel is unique is called as a *Cluster*.

Since co-channel cells use the same set of channels, there is always possibility of interference in these cells. Interference between the co-channel cells is called as *Co-channel interference*. There should be a minimum Distance after which the same channel can be reused with minimum interference. This distance is called as Minimum safe distance and is given by,

$D=\sqrt{3N}xR$
Where N is the Cluster size and R is the Radius of each cell.

The number of cells after which a frequency channel can be reused is called as the *Frequency reuse factor (R.F)*. It is given by R.F=1/N, Where N is the cluster size.