Quiz Solutions

Lecture 4,5,6,7,8

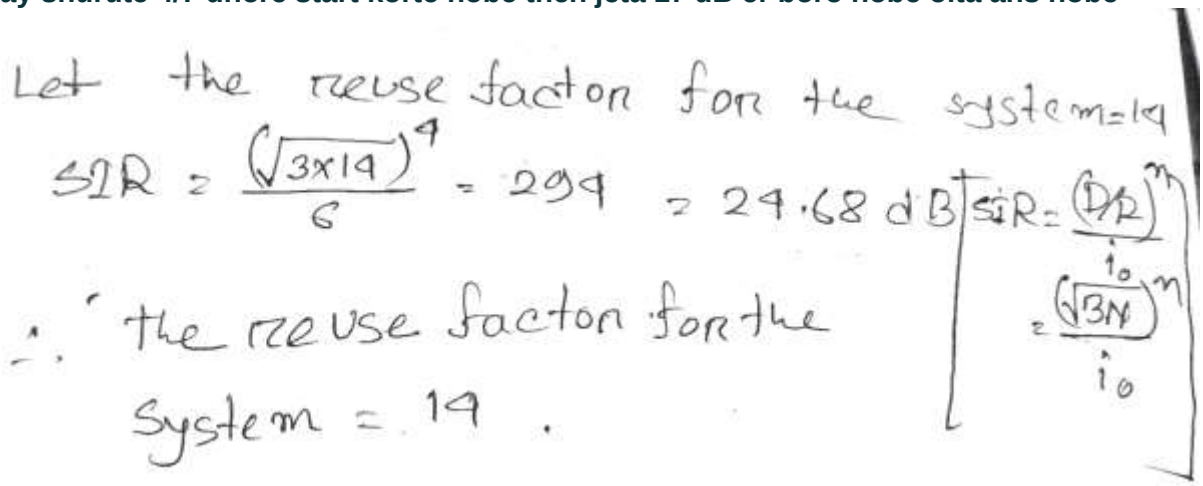
Quiz-2 - Integer43

Set-A

1. a) Consider the advanced mobile phone system in which an S/I ratio of 17 dB is required for the accepted voice quality. What should be the reuse factor for the system? Assume path loss exponent n=4

Solution:by 132

Etay shurute 4/7 dhore start korte hobe then jeta 17 dB er boro hobe oita ans hobe



1. b) The CCI will increase or not if we increase co channel reuse ratio? Why? [1]

Solution: by Rabab 039

An increase in co-channel reuse ratio means increasing distance between co-channels while keeping the cell radius same [∵ Q ∝ D]. Therefore, it decreases CCI.

Alternative answer:

An increase in co-channel reuse ratio means increasing reuse factor N i.e. increasing cluster size [∵ Q ∝ N]. Therefore, it decreases CCI.

1. c) Determine the signal-to-co-channel interference ratio at the mobile receiver located at the boundary of its omnidirectional operating cell in a cellular system designed with N = 4 and n=3. [2]

Solution: added by Tamal-122

Here, $N = 21$, $n = 3$

$$Q = \sqrt{3N} = \sqrt{3 \times 21} = 3.2164$$

$$SIR = \frac{1}{2(Q+1)^{-n} + 2Q^{-n} + 2(Q-1)^{-n}}$$

$$= \frac{1}{2(3.2164+1)^{-3} + 2(3.2164)^{-3} + 2(3.2164-1)^{-3}}$$

$$= 4.8921$$

$$10 \times \log_{10}(4.8921) = 6.896 \text{ dB}$$

2. a) Determine the distance from the nearest co-channel cell for a cell having a radius of 0.3 km and shift parameters i=3 and j=1 in a regular hexagonal geometry pattern. [1.5]

Solution:

Rifat–105

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We know,

$N = i^2 + ij + j^2$

$= 3^2 + 3x1 + 1$

$= 13$

D = R x sqrt(3xN)

= 0.3 x sqrt(3x13)

= 1.873 km

2. b) What happen if we take handoff margin too small? [1]

Solution: ***Added from the Answer script by Younus-131***

If we take the handoff margin too small, it will increase the probability of call drop.

Or There may be insufficient time to complete a handoff before a call is lost due to weak signal conditions.

2. c) Suppose that a mobile station is moving at a speed of 50 km/hr along a straight line between base stations BS1 and BS2. The received power at a reference distance 1m is equal to 50 watt. For n = 3, a cell radius of 1.5 km and a 3 second handoff, what is Pr (min usable) and Pr (Handoff) in dB? [3]

Solution: O24

We know, Pr = Po x (d / do)^(−n)

Po = 50 W
do = 1 m
Cell radius = 1.5 km = 1500 m

Pr (min usable) = 50 x (1500 / 1)^(-3) = 1/67500000 W = -78.29 dB

Speed = 50 kmp
h = 125/9 m/s
Handoff distance = 1500 - (3 x (125/9)) = 4375/3 m
Pr (Handoff) = 50 x ((4375/3) / 1)^(-3) = 1.61212828x10^(-8) W = -77.93 dB

Alternative:
We know, Pr = Po x (d / do)^(-n) => Pr = Po - 10 x n x log(d)

Po = 50 W = 10 x log(50) dB = 16.98970004 dB
Cell radius = 1.5 km = 1500 m

Pr (min usable) = 16.98970004 - 10 x 3 x log(1500) = -78.29 dB

Speed = 50 kmph = 125/9 m/s
Handoff distance = 1500 - (3 x (125/9)) = 4375/3 m
Pr (Handoff) = 16.98970004 - 10 x 3 x log(4375/3) = -77.93 dB

Set-B

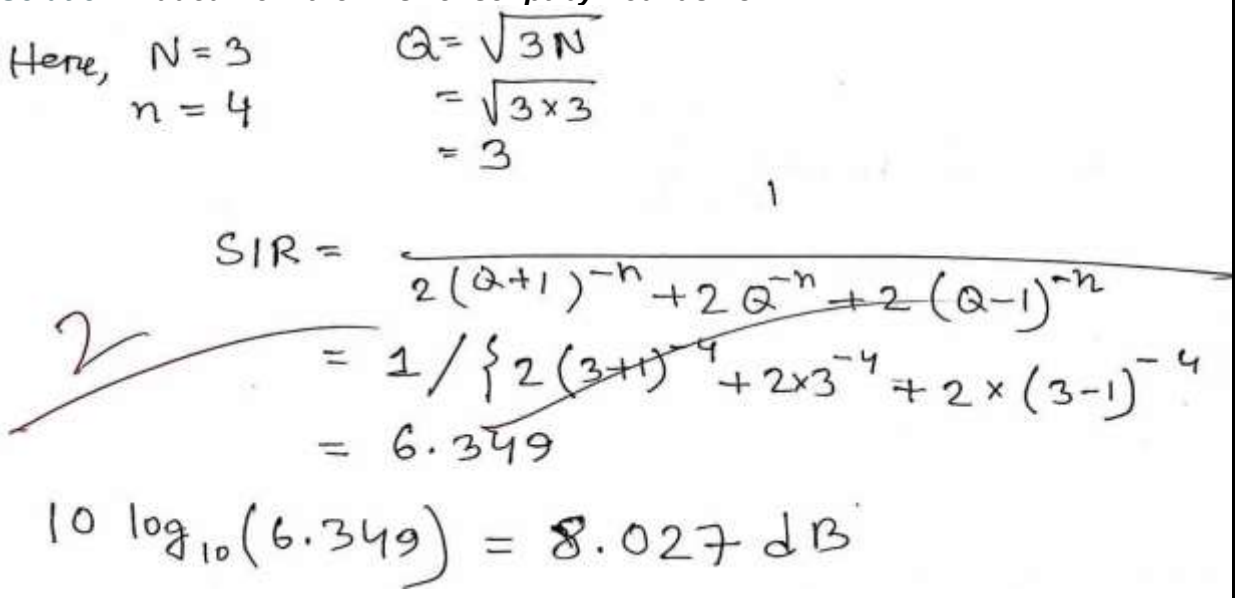
1. a) If signal-to-interference ratio of 16 dB is required for satisfactory forward channel performance of a cellular system, what is the co-channel reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is n=3? [1.5]
Solution:

1. b) Which call do you give priority and why-drop call or block call? [1]
Solution: by Rabab 039

Blocked call. Because, from a user's perspective, a call dropped in the middle of a conversation is more problematic than a call blocked beforehand.

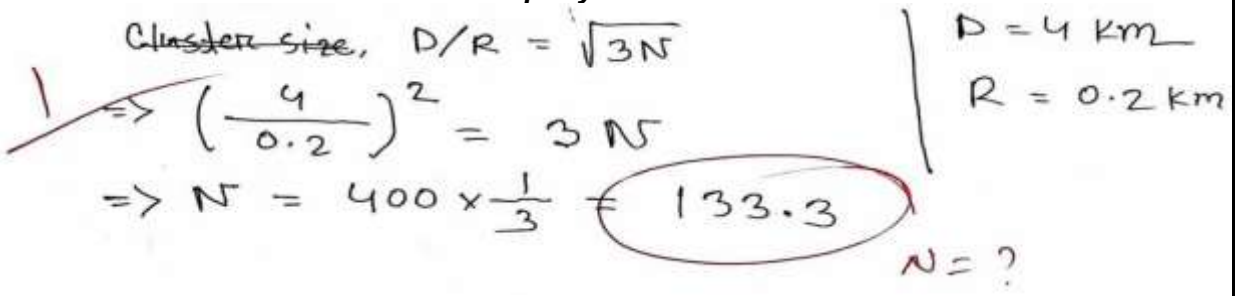
1. c) Determine the signal-to-co-channel interference ratio at the mobile receiver located at the boundary of its omnidirectional operating cell in a cellular system designed with N = 3 and n=4. [2]

Solution: ***Added from the Answer script by Younus-131***



2. a) Determine the cluster size for a cellular system having a distance of 4 km from the nearest co-channel cell for a cell and a radius of 0.2 km.
[1.5]

Solution: ***Added from the Answer script by Younus-131***



0.5 marks keno katche jani naaa, karo kache accurate answer thaklee eta k replace kore dis - Younus 131

N er value fraction hobe na, so N = 134 hobe. (130).

- From geometry of hexagons is such that the number of cells per Cluster, N, can only have the values which satisfy equation

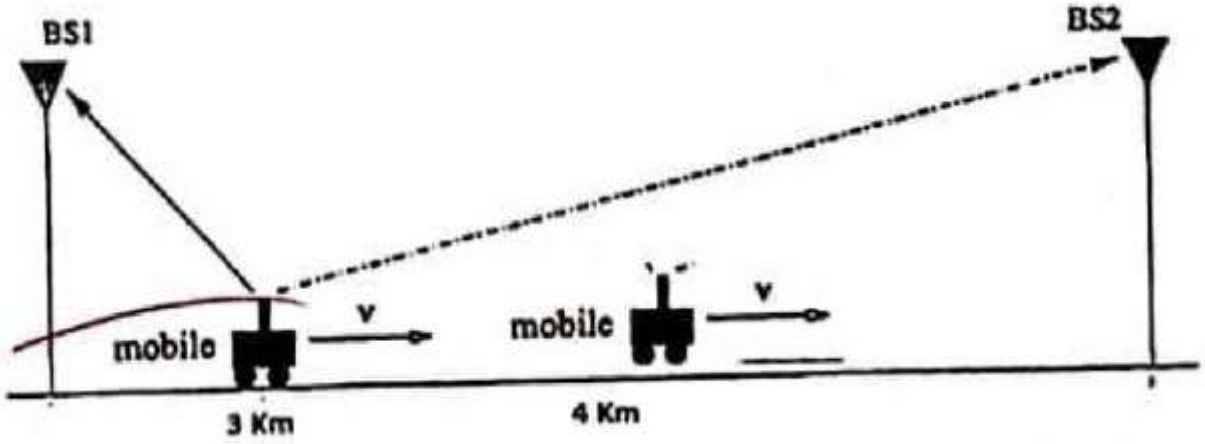
$$N = i^2 + ij + j^2$$

Mark katche karon N er value ei equation ta satisfy korte hobe, 133 er nearest value paua jabe i = 3, j = 10 er jonno, N er value hobe 139 - Srishti 101

2. b) What happen if we do not use power control mechanism? [1]

Solution:

2. c) Suppose that a mobile station is moving along a straight line between base stations BS1 and BS2, as shown in figure. Assume that Po= 0 dB, do = 1 Km, n = 2 and the threshold value = -99 dB. Determine the necessary power value and show the hand off will take place or not according to Relative SS with threshold strategy. [3]



Solution: 2.c. added by Tamal-122

given, $P_o = 0dB$, $d_o = 1km$, $n = 2$, Threshold $= -99dB$

$$P_{r\,old} = P_o - 10n \log\left(\frac{d/d_o}{10^{-3}}\right)$$

$$= 0 - 10 \times 2 \times \log\left(\frac{3\times10^3/1\times10^3}{10^{-3}}\right)$$

$$= -69.542$$

$$P_{new} = P_o - 10n \times \log\left(\frac{d/d_o}{10^{-3}}\right)$$

$$= 0 - 10 \times 2 \times \log\left(\frac{4000/1000}{10^{-3}}\right)$$

$$= -72.041$$

as $P_{new} > P_{old}$ and $T > P_{old}$

$\therefore$ Handoff will take place.

Only d/do dia korleo prb nai. 10^-3 is divided just for dBm unit.

Quiz-3 - Integer43

Set-A

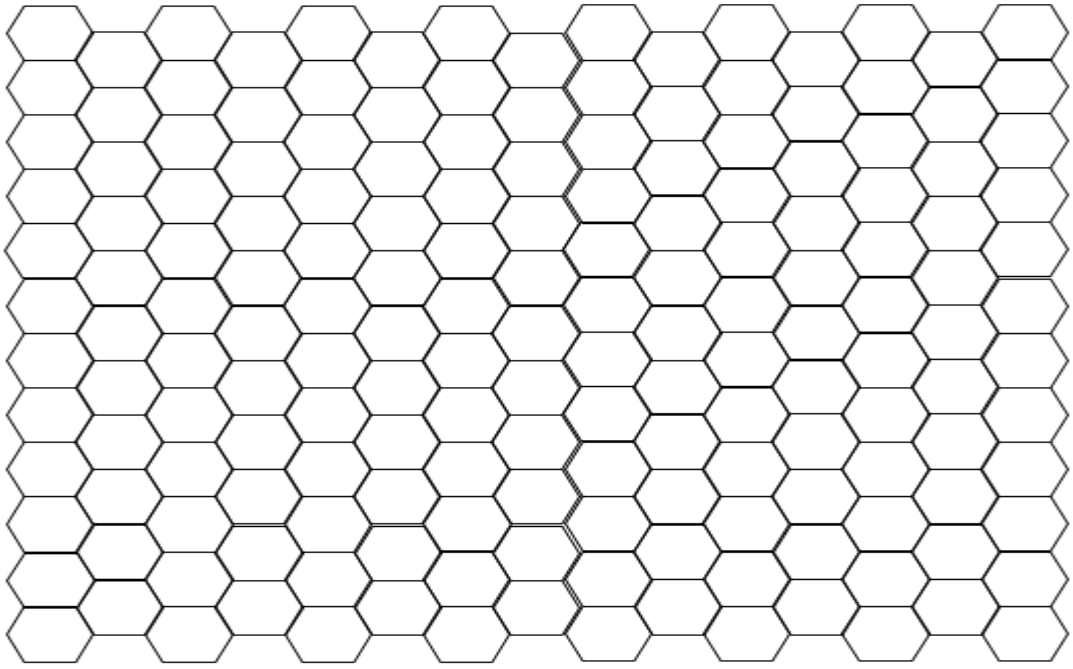
1. a) What do you mean by 0.5 Erlang?

Solution:
0.5 Erlangs means a radio channel is occupied for thirty minutes during an hour and carries 0.5 Erlangs of traffic. –Rifat 105

1. b) What is the problem of cell splitting? [1]
Solution:
► Cell splitting increases the number of base stations in order to increase capacity.
► Decreasing the cell radius in different size may increase CCI.
► Handoff may frequently for high speed traffic. The umbrella cell approach is commonly used
Swarna(061)

2. A total of 43.2 MHz of bandwidth is allocated to a particular FDD cellular system that uses 15 kHz simplex channel. If each cell covers 5 km^2 and the cellular system support total area of 50 km x 50 km. Assume reuse factor of N = 12 and path loss of n =4. Now answer the following questions:

2. a) Identify the number of interferer co channel cell for 60º sectoring.



Solution:

2. b) Calculate the SIR in dB for the omnidirectional antennas and 60° sectoring
Solution:

2. c) Find the number of users for each sector and each cell using 60° sectoring that can be supported at 0.5% blocking in an Erlang-B system, if each user averages three calls per hour at an average call duration of one minute

Solution:

3. Consider a cellular system where each cell has a radius of 5 Km and transmit power 150 W. If cell splitting technique is applied, then find the base station power in dB of each micro cell. Assume path loss n = 4.

Solution: ***by Younus-131***

$$P_{t_2} = P_{t_1} \times \left(\frac{1}{2}\right)^n$$

$$= 150 \times \left(\frac{1}{2}\right)^4$$

$$= 9.375 \text{ W}$$

$$= 9.72 \text{ dB}$$

Set-B

1. a) When do we use Erlang-B chart? [1]

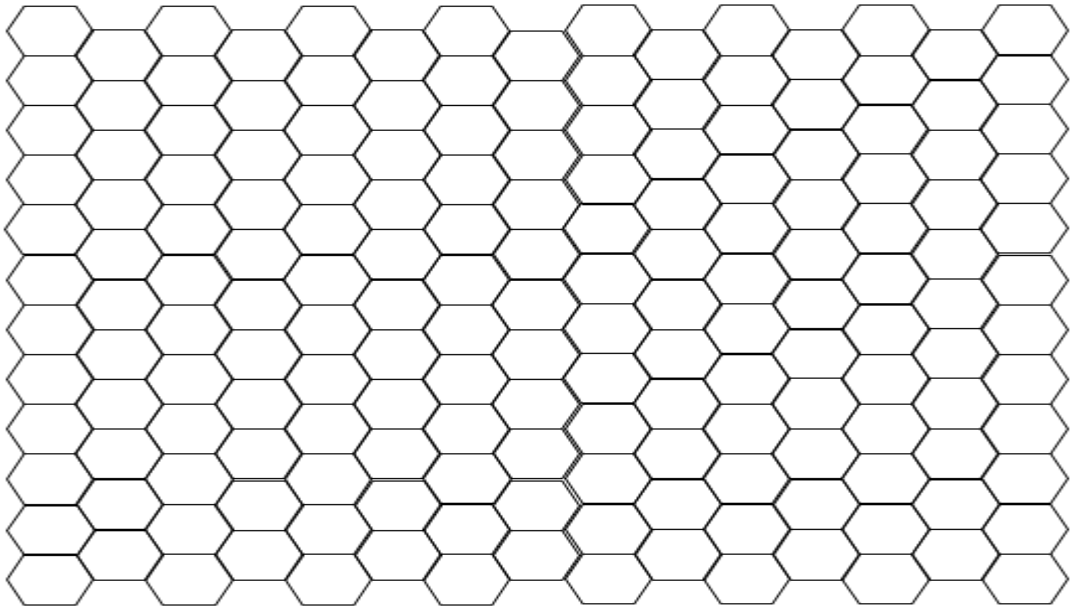
Solution: 109
We use Erlang-B chart to find the traffic intensity when we know the value at trunked channel number and GOS (Grade of service). Erlang B for blocked calls clear.

1. b) What is request rate? [1]

Solution:Swarna(061)
Request Rate: The average number of calls requests per unit time(λ)

2. Consider a geographic area of 213 Km² is covered by a FDD cellular system with a cell radius of 1.6 km. A total of 8.64 MHz of bandwidth is allocated which uses 5 KHz simplex channel and a reuse factor of N = 12. Assume path loss, n =4. Now answer the following questions:

2. a) Identify the number of interferer co channel cell for 120° sectoring.



Solution:

2. b) Calculate the SIR in dB for the omnidirectional antennas and 120° sectoring [1]

Solution:

2. c) Find the number of users for each sector and each cell using 120° sectoring that can be supported at 1% blocking in an Erlang-B system, if each user averages two calls per hour at an average call duration of three minutes.

Solution:

3. Consider a cellular system where each cell, has a radius of 3 Km and transmit power 250 W. If cell splitting technique is applied, then find the base station power in dB of each micro cell, Assume path loss n = 3.

Solution: ***by Younus-131***

$$P_{t_2} = P_{t_1} \times \left(\frac{1}{2}\right)^n$$
$$= 250 \times \left(\frac{1}{2}\right)^3$$
$$= 31.25\,\omega$$
$$= 14.95\,dB$$

Set-D

1. a) When do we use Erlang-C chart? [1]

Solution:

1. b) What is Holding Time? [1]

Solution:

2. Consider a geographic area of 300 Km^2 is covered by a FDD cellular system with a cell radius of 1.5 km. A total of 15 MHz of bandwidth is allocated which uses 2.5 KHz simplex channel and a reuse factor of N = 13. Assume path loss, n =4. Now answer the following questions:

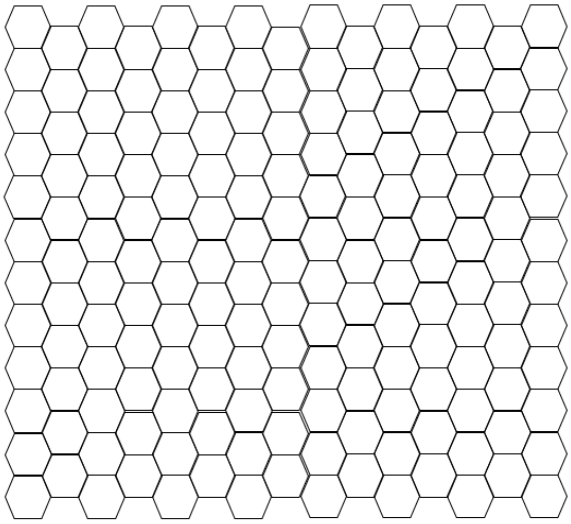
2. a) Identify the number of interferer co channel cell for 120° sectoring.

Solution:

2. b) Calculate the SIR in dB for the omnidirectional antennas and 120° sectoring [1]

Solution:

2. c) Find the number of users for each sector and each cell using 120° sectoring that can be supported at 1% blocking in an Erlang-B system, if each user averages two calls per hour at an average call duration of three minutes.



Solution:

3. Consider a cellular system where each cell, has a radius of 3 Km and transmit power 250 W. If cell splitting technique is applied, then find the base station power in dB of each micro cell, Assume path loss n = 3.

Solution: ***by Younus-131***

$$P_{t_2} = P_{t_1} \times \left(\frac{1}{2}\right)^n$$

$$= 250 \times \left(\frac{1}{2}\right)^3$$

$$= 31.25\,\omega$$

$$= 14.95\,dB$$