Unit 4 - Cellular System Design, Capacity, Handoff, and Outage

Assignment 3

The due date for submitting this assignment has passed. Due on 2019-08-21, 23:59 IST.
As per our records you have not submitted this assignment.

This assignment is based on Lectures 10-14, covering the following topics – Cellular system design, Cellular geometry, Erlang Capacity, Trunking efficiency, Handoff, Classification of Signal Variation, Shadowing, Multipath and Outage

1) Which of the following is not a valid cluster size (assume hexagonal cells)? *1 point*

- 7
- 11
- 27
- 19

No, the answer is incorrect.
Score: 0
Accepted Answers:
11

2) Consider an N-cell reuse pattern (hexagonal geometry) with base stations at the center of each cell with omni-directional antennas. What would be the D/R ratio required if a minimum value of C/I = 15dB must be ensured. Assume path loss exponent n = 3 and only tier 1 interferers *1 point*

- 4.53
- 3.16
- 5.74
- 3.58

No, the answer is incorrect.
Score: 0
Accepted Answers:
5.74

3) Consider an N-cell reuse pattern (hexagonal geometry) with base stations at the center of each cell with omni-directional antennas. What would be the value of N that will ensure that a minimum C/I = 15dB is maintained. Assume path loss exponent n = 2.5 and only tier 1 interferers are present. *1 point*

- 14
- 24
- 27
- 17

No, the answer is incorrect.
Score: 0
Accepted Answers:
27

4) Consider a cellular system with N=3 (hexagonal cells, BTS (base station) at the center of cell with omnidirectional antenna) with path loss exponent n = 2.5. Assume that MS (mobile station) is at the worst case C/I situation (at a vertex). Compute via geometric estimation the C/I due to tier 1 interferers only. *1 point*

Hint: Since N=3 is small, you need to calculate the distance of the MS from all the tier 1 interferers via geometric estimation.

- 5.35 dB
- 3.33 dB
- 4.21 dB
- 8.63 dB

No, the answer is incorrect.
Score: 0
Accepted Answers:
3.33 dB

5) Consider a cellular system with N=3 with hexagonal cells. Antenna sectorization is introduced in the system. What is the number of tier 1 interferers if 120 degree sectorization is employed? Assume that the base station is at the center of the cell and evaluate for the worst case interference. *1 point*

- 4
- 3
- 5
- 6

No, the answer is incorrect.
Score: 0
Accepted Answers:
3

6) Repeat problem 5 if 60 degree sectorization is employed. Again evaluate for the worst case interference *1 point*

- 3
- 4
- 2
- 5

No, the answer is incorrect.
Score: 0
Accepted Answers:
2

7) Which of the following is the most favorable action for a cellular system to take which receives high RSSI but low RxQual (SINR) ? *1 point*

- Frequency hopping
- Intracell handover
- Intercell handover
- Either *(a)* or *(b)*

No, the answer is incorrect.
Score: 0
Accepted Answers:
Either (a) or (b)

8) A cellular service provider implements a digital TDMA system which requires a minimum signal-to-interference ratio of 9 dB. Assume that only Tier-1 interferers need to be considered and the approximation that all Tier-1 interferers are equidistant from the mobile station. What is the optimal value of N considering omni-directional antennas? (Assume a path loss exponent of *n =3*) *1 point*

- *7*
- 3
- 4
- 5

No, the answer is incorrect.
Score: 0
Accepted Answers:
7

9) Consider a cellular system consisting of 10 users. Each user makes an average of 2 calls per hour. Each call, on average, lasts for 6 minutes. What is the total offered traffic (in Erlang)? *1 point*

- 0.5 Erlang
- 1.0 Erlang
- 1.5 Erlang
- 2.0 Erlang

No, the answer is incorrect.
Score: 0
Accepted Answers:
2.0 Erlang

10) What is the blocking probability if a system with 50 channels has a maximum capacity per channel of 0.758 Erlangs? *1 point*

(Use the Erlang-B calculator given in http://www.erlang.com/calculator/erlb/)

- 0.001
- 0.01
- 0.015
- 0.02

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.01

11) A cellular system has a cluster size N. It is given that a total of 280 voice channels are available, and users are uniformly distributed over the geographic area covered by the cells. Each user generates 0.05 Erlangs of traffic. Assuming that blocked calls are cleared and that the target blocking probability is 2%. (Use the Erlang-B calculator given in http://www.erlang.com/calculator/erlb/) *1 point*

What is the maximum number of users per cell that can be supported for cluster size N = 7?

- 815
- 420
- 147
- 619

No, the answer is incorrect.
Score: 0
Accepted Answers:
619

12) A cellular system has a cluster size N. It is given that a total of 280 voice channels are available, and users are uniformly distributed over the geographic area covered by the cells. Each user generates 0.05 Erlangs of traffic. Assuming that blocked calls are cleared and that the target blocking probability is 2%. (Use the Erlang-B calculator given in http://www.erlang.com/calculator/erlb/) *1 point*

What should be the reduction in offered traffic to maintain the same Grade-of-Service (GOS) if two channel in each cell is reserved for handoff traffic? (Assume cluster size is N = 7)

- 0.9 Erl
- 1.2 Erl
- 1.5 Erl
- 1.8 Erl

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.8 Erl

13) (Rappaport 3.11) For an N =7 system with blocking P = 1% and average call length of two minutes, find the capacity loss (in terms of No. of users per cell) due to trunking for 60 channels / cell when going from omni-directional antenna to 60 degree sectored antennas. Assume blocked calls are cleared and the average user call rate is 1 call per hour. (Use the Erlang-B calculator given in http://www.erlang.com/calculator/erlb/) *1 point*

- 421 users /cell
- 1407 users /cell
- 606 users /cell
- 798 users /cell

No, the answer is incorrect.
Score: 0
Accepted Answers:
606 users /cell

14) Which of the following fact is true about the maximum per-channel capacity for a given Pr(blocking)? *1 point*

(Hint: You may use the Erlang-B calculator given in http://www.erlang.com/calculator/erlb/) The plot of per-channel capacity versus No. of Channels used is

- Concave downwards function
- Convex downwards function
- Neither concave nor convex
- Constant

No, the answer is incorrect.
Score: 0
Accepted Answers:
Concave downwards function

15) Which of the following statements are true upon increasing the number of cells in the cluster? *1 point*
I) the C/I reduces
II) Erlang capacity increases

- Only I is true
- Only II is true
- Both I and II are true
- Neither I nor II is true

No, the answer is incorrect.
Score: 0
Accepted Answers:
Neither I nor II is true

16) A mobile phone receiver operates in a bandwidth of 2MHz at 300 K and has a noise figure 4 dB. The receiver is present on the cell edge and minimum 3 dB SNR is required for reliable communication. Consider log normal shadowing effects with $\sigma = 6$ dB. Carrier frequency = 2 GHz. To achieve 90% coverage probability, find the mean received power. Make use of the data: Q(1.2816) = 0.1. *1 point*

- -111.7 dBm
- -96.3 dBm
- -117.7 dBm
- -103.3 dBm

No, the answer is incorrect.
Score: 0
Accepted Answers:
-96.3 dBm

17) A mobile phone receiver operates in a bandwidth of 2MHz at 300 K and has a noise figure 4 dB. The receiver is present on the cell edge and minimum 3 dB SNR is required for reliable communication. Consider log normal shadowing effects with $\sigma = 6$ dB. Given there is maximum power constraint of 1mW that a base station can transmit, find the maximum radius of the cell for 90% coverage probability. Assume free space path loss model. Carrier frequency = 2 GHz. Make use of the data Q(1.2816) = 0.1 *1 point*

- 0.78 km
- 1.2 km
- 1.43 km
- 20.5 km

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.78 km

18) Consider transmission @ 2.4GHz. If the user is moving at 108 kmph towards the base station, find the maximum Doppler shift. *1 point*

- 864 Hz
- 86.4 Hz
- 240 Hz
- 24 Hz

No, the answer is incorrect.
Score: 0
Accepted Answers:
240 Hz

19) In a normalized U-V coordinate system, consider two points with the following coordinates: Point A (1,2) and Point B (5,4). What is the actual distance between points A and B if the side of each hexagon is R=1 km *1 point*

- 5.3 km
- 9.2 km
- 28 km
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
9.2 km