

Solution

Course Title: Mobile Communication s	Date: 17/11/2009
Course No: (650539)	Time Allowed: 1 Hours
Lecturer: Dr. Abdel-Rahman Al-Qawasmi	No. of Pages: 2

Question1

10 marks

A hexagonal cell within a seven-cell system has a coverage area 7 sq km. In each cell allocated 50 radio channels. The total traffic intensity equals to 20 Erlangs and the average number of call requests per unit time for each user equals to three calls per hour. Compute the following:

- 1- The radius of the cell.
- 2- The traffic intensity per user if the average duration of a call is 9 minutes
- 3- Supported number of users per square kilometer.
- 4- The traffic intensity per channel.
- 5- What is the probability that a delayed call will have to wait for more than a 5 seconds?
- 6- What is the probability that a call will be delayed for more than 7 seconds if the probability blocking delayed call is 9%?

Solution:

1- The cell radius can be found using the equation:

$$\text{Area} = 2.598(R^2).$$
$$R = \sqrt{\frac{\text{Area}}{2.598}} = \sqrt{\frac{7}{2.598}} \approx 1.64 \text{ km} \quad (1)$$

2- The traffic intensity per user $A_u = \lambda H = \left(\frac{3}{60}\right) \times 9 = 0.45$ Erlangs (2)

3- First, we find the number of user per cell:

$$U = \frac{A}{A_u} = \frac{20}{0.45} \approx 44 \text{ Users}$$

Then the supported number of user per square kilometer = $\frac{U}{\text{area}} = \frac{44}{7} \approx 6$ users per cell (2)

4- $A_c = A / C = 20 / 50 = 0.4$ Erlangs per channel. (1)

5- $P_r[\text{delay} > 5 | \text{delay}] = \exp(-(C - A) \frac{t}{H}) = \exp(-(50 - 20) \frac{5}{9 \times 60}) = 0.757$ (2)

6- $P_r[\text{delay} > 7] = P_r[\text{delay} > 0] P_r[\text{delay} > 7 | \text{delay}] = \left(\frac{9}{100}\right) \left[\exp(-(50 - 20) \frac{7}{9 \times 60})\right] =$ (2)

Question2

10 marks

1- Communication industry has grown during the past years because of the:

- a) Development of new switching techniques.
- b) Integration of new large-scale circuits.
- c) Using of AM techniques.
- d) a+b**
- e) None of the above.

2- Digital European Cordless Telephone (DECT) standards Developed in Europe with base stations mounted on street lights or on sides of buildings with no handoff because:

- a) It is a short range access to AMPS.
- b) It uses the 800 MHz bandwidth
- c) It is a short range access to PSTN.**
- d) It is a full-Duplex System
- e) None of the above

3- The first universal digital cellular system (900 and 1800 MHz) is GSM which stands for:

- a) Global System for Mobile**

- b) Global Standard for Modulation
- c) Global Standard for Mobile
- d) Global System for Modulation.
- e) None of the above.

4- GSC is a paging system with

- a) Full-duplex multiple access
- b) Half-duplex multiple access
- c) **Simplex multiple access**
- d) b+c
- e) None of the above

5- FDD and TDD are used in:

- a) Simplex communication systems
- b) Half-duplex communication systems
- c) **Full-duplex communication systems**
- d) Paging systems.
- e) None of the above.

6- A portable device is a device that:

- a) Attached to a high speed mobile platform (high speed vehicle).
- b) **Can be held and used by someone at walking speed.**
- c) Attached to a very high speed mobile platform (high speed vehicle).
- d) Can be held and used by someone at very high speed.
- e) None of the above.

7- The actual radio coverage of a cell is known as

- a) **Footprint and is determined from field measurements.**
- b) Footprint and is determined from the equation $2.598(R^2)$.
- c) Theoretical area and is determined from field measurements.
- d) Actual area determined from the equation $2.598(R^2)$.
- e) None of the above.

8- Cell is defined as:

- a) **A small geographic area in which a group of radio channels are allocated by a base station.**
- b) A hexagonal Shape that covers a number of clusters using the frequency reuse.
- c) A small geographic area in which a group of radio channels are allocated by a mobile device.
- d) A hexagonal Shape that covers a number of users using the handoff.
- e) None of the above.

9- Total Number of duplex channels in a cellular system can be defined as

- a) The complete set of available frequencies used by N cells.
- b) Number of Channels per cell
- c) **The number of cells per cluster multiplied by the number of channels per cell.**
- d) Number of replication of cluster multiplied by the Number of Channels per cell
- e) None of the above.

10- The time over which a call may be maintained within a cell, without handoff is called

- a) **The dwell time**
- b) The call setup time
- c) The call waiting time
- d) The average call time
- e) None of the above.