Wireless Networking

Course code: CS4222/5422, Tutorial session: #9

Brief Instructions regarding the tutorial session

1. The attendance to tutorial sessions would contribute towards the determination of final grade
2. Please review the questions before coming to the tutorial session
3. Make an effort to solve the questions before attending tutorial. The teaching assistants will help in case of issues
4. The designated time for the tutorial session is one hour. Please contact the teaching assistants or the instructor if you need any further clarification regarding the tutorials outside the allocated period. Please send them an email.

Question 1:

Pros of 2-FSK:

• 2-FSK is inherently straightforward and enjoys widespread support among radio chipsets, making it a highly accessible option.

• Its substantial transmission range is sufficient for air quality sensing applications, ensuring effective monitoring over long distances.

• As it is not tied to any commercial network, 2-FSK offers maximum flexibility for network designers and eliminates the need for subscription fees.

• Capable of supporting high data throughputs, 2-FSK can handle a large volume of information.

Cons of 2-FSK:

• When compared to CSS-based LoRa transceivers, 2-FSK has a relatively shorter range (sensitivity).

• CSS offers orthogonality, enabling multiple transmitters to share frequency without negatively interfering with one another. This feature may not be possible with 2-FSK.

Pros of LoRa:

• LoRa provides the highest range and reliability, ensuring strong performance in various applications.

• Operating in an unlicensed band, LoRa avoids the need for costly licenses and permits.

• With numerous network service providers deploying LoRa networks, the existing infrastructure can be easily reused, reducing costs and streamlining implementation.

Cons of LoRa:

• LoRa has limited throughput capabilities, which may restrict the volume of data that can be transmitted.

• As a commercial standard, some aspects of LoRa are proprietary, potentially limiting accessibility and customization.

• LoRa is more complex than 2-FSK, which could lead to increased implementation challenges and maintenance requirements.

We assume that TDMA is not being considered.

One 2-FSK transmission: 125 KHz

Maximum number of FDMA transmissions: 3 MHz/ 125 kHz = 24 concurrent transmissions

For LoRa:

Since, we can have nodes with orthogonal spreading factors, we can have much larger number of transmitters than 2-FSK. Exact number requires additional information.

Answer 2: N = 17, Prob = 1 – 365!/(365^17(365-17)!) ~ 1 – 0.685 = 0.315

Answer 3:

a) P(both active) = 0.1 x 0.1 = 0.01
Average = 1/0.01 = 100 slots or 20 sec.

b) More frequent transmission may improve chances of discovery, but if there are more nodes in the neighbourhood, frequent transmissions can also result in frequent interference resulting in lower discovery performance.

Answer 4:

tan (40) = x/y, tan(60) = (10-x)/ y
tan 40 = 0.8391 = x/y, x = 0.8391y

tan 60 = 1.732 = (10-x)/y, 1.732 y = 10 – 0.8391y,

y = 3.889

x = 3.263

Answer 5:

a) We can estimate ETX for the following links:

1->3: 10/9 = 1.11
1->2: 10/9 = 1.11
1->6: 10/8 = 1.25
1->4: 100/85 = 1.17
4->7: 10/8 =1.25
5->7: 100/95 = 1.05
1->4: 100/85 = 1.17
3->5: 100/95 = 1.05
2->5: 10/9 =1.11
2->4: 10/7 = 1.43

b) Minimum hop count: 1 -> 4 -> 7 or 1->6->7

Lowest ETX path: (1->6) + (6->7) = 1.25 + 1.11 = 2.36

c) Path with lowest ETX; (1->6) + (6->7), we need smallest number for expected transmissions for successful reception