

The LNM Institute of Information Technology

Computer Science and Engineering

Computer Networks (CN)

Mid Term

Time: 90 minutes

Date: February 17, 2018

Max. Marks: 50

Read the following instructions carefully:

- *There are 6 questions printed on both sides of the paper.*
- **Negative marking.** *Answer to each question that carries 2 marks must be limited to 50 words. You will be charged (-2) each time you exceed this limit.*
- **No marks** for providing just expressions/answers unless accompanied with correct justification and/or derivation.
- *In case of any doubt, make your assumption, write it clearly and continue.*

| 4-Bit Data Symbol | 5-Bit Code |
|-------------------|------------|
| 0000 | 00001 |
| 0001 | 10110 |
| 0010 | 01011 |
| 0011 | 01010 |
| 0100 | 10101 |
| 0101 | 10100 |
| 0110 | 10001 |
| 0111 | 10000 |
| 1000 | 01101 |
| 1001 | 01100 |
| 1010 | 01001 |
| 1011 | 01000 |
| 1100 | 00101 |
| 1101 | 00100 |
| 1110 | 00011 |
| 1111 | 00010 |

1. Encoding schemes.

- (a) Consider an encoding called Madrid that merges clock with the signal. It transmits XOR of NRZ encoded data and the clock. This scheme considers the clock as some internal signal that alternates from low to high. Each low-high pair is considered as one clock cycle. How does the encoding Madrid perform with respect to:
 - i. baseline wander
 - ii. clock recovery
- (b) Consider a variant of the 4B/5B scheme, let's call it VARIANT. Its conversion from 4 bits to 5 bits is provided in the table.

- i. Which problem does VARIANT suffer from?
- ii. Suggest an encoding to solve the problem stated in part i?

(2+2)+(2+2) Marks

2. Internet Economics.

Consider the situation in Figure 1 and answer the questions below.

- (a) Write the best path that can be taken in the given figure to send a packet from Airtel to Aircel.
- (b) Write the paths that will never be taken to reach to Orange from Idea.
- (c) Can BSNL make any profit in above scenario? Its only two **customers ASes** are peering, can it be carrying any profit earning traffic?

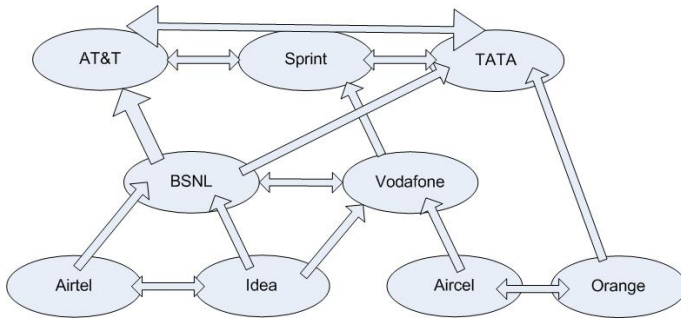


Figure 1: BGP relationships: One sided arrow is directed from customer to provider. Two sided arrows imply a peering relationship between the ASes.

- (d) Orange is a direct customer of TATA, i.e., there is a direct connection between Tier-1 and Tier-3 ISP. Should it be valid? Comment.

2+2+2+2 Marks

3. Wireless 802.11

Explain the following with the help of diagrams. Pay special attention to the correctness of the diagram:

- Hidden node problem
- Exposed node problem
- Distribution system (no node mobility)

2+2+2 Marks

4. Data Link Protocols

Consider an Ethernet (Media Access) with the features described next. In this, the maximum length of the Ethernet (including repeaters) can be 1000 meters. The speed of the signals in the cable used is 2.5×10^8 m/s, and the bandwidth is known to be 10 Mbps. Answer the questions below:

- What is the RTT for the worst case scenario?
- What is the minimum size of the frame for this Ethernet network?
- Justify the minimum size of the frame.
- Assume the above parameters for wireless 802.11, i.e., the maximum range to be 1000 meters, speed of the signal to be 2.5×10^8 m/s and the data-rate to be 10Mbps. What is the minimum size of 802.11 frame in this case?

2+2+2+2 Marks

5. Error Detection

We want to send a message from a host to another. Assume that they are using CRC for error detection at the link layer. The message to be sent is 10110111 and it is given that the $C(x)$ for CRC is $x^3 + x^2 + 1$. Answer the questions below:

- What is the actual message that the sender sends to the receiver?
- How does the receiver interpret this message sent by the sender?
- Corresponding to the message sent in part 5a, let the receiver receives 11100011001. What should it do?
- Figure 2 shows the Internet traffic growth for years 2015-2020. Assume that the Ethernet CRC is such that the probability of errors in a frame go undetected is 10^{-40} if frame size is up to 2500 bytes. Comment (mainly qualitatively) on how good or bad this CRC is?

Global IP Traffic Growth / Top-Line

Global IP traffic will increase 3-fold from 2015–2020

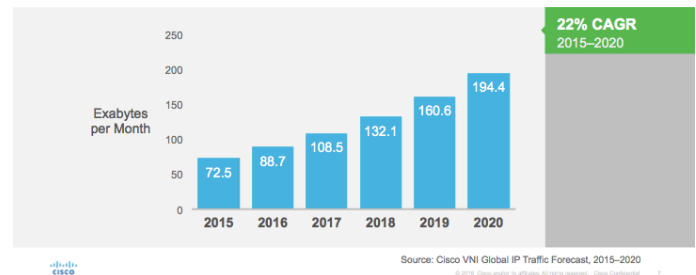


Figure 2: Growth on Internet traffic. See the huge amount of traffic. Exa represents 10^{18} .

2+2+2+2 Marks

6. Sliding window

The meanings of the variable is same as taken in the class.

- Draw the four scenarios that were discussed in class related to Stop and Wait. Label the figures properly. No marks if the figures are not self explanatory.
- When the sender uses just one bit for sequence numbering. Why both 0 and 1 cannot be sent simultaneously?
- If $RWS = SWS$, prove that $SWS < \frac{(MaxSeqNum+1)}{2}$
- Consider 10Mbps link with 800 millisecond of RTT.
 - What is the throughput if Stop and Wait is used?
 - How many frames can be sent over it?

2+2+4+(2+2) Marks