MASSEY UNIVERSITY
PALMERSTON NORTH CAMPUS

MID-SEMESTER TEST FOR
159.334 COMPUTER NETWORKS

Semester Two - 8th September 2010

MODEL ANSWERS

*Question 1 – Short Answer Questions - **ANSWERS***

1.1 Which of the OSI Layers handles each of the following:

a. Dividing the transmitted bit stream into frames. Data Link Layer
b. Determining which route through the subnet to use? Network Layer *[2 marks]*

1.2 Frequency of failure and network recovery time after a failure are measures of the _____ of a network.

a. Performance
b. Reliability
c. Security
d. Feasibility *[1 mark]*

1.3 _____ is the protocol suite for the current Internet.

a. TCP/IP
b. NCP
c. UNIX
d. ACM *[1 mark]*

1.4 To guarantee the detection of up to 6 errors in all cases, the minimum Hamming distance in a block code must be _____.

a. 6
b. 7
c. 13
d. none of the above

Give reasons for your answer: Distance = s + 1 to detect, so if s = 6, then distance required is 7. *[2 marks]*

1.5 To guarantee correction of up to 7 errors in all cases, the minimum Hamming distance in a block code must be _____.

a. 6
b. 7
c. 13
d. none of the above (It is actually 15)

Give reasons for your answer: Distance = 2t + 1 to detect, so if t = 7, then distance required is 2x7+1 = 15, hence, none of the above answers is correct. *[2 marks]*

1.6 A _____ is a set of rules that governs data communication.

a. forum
b. protocol
c. standard
d. none of the above *[1 mark]*

1.7 In cyclic redundancy checking, what is the CRC?

a. The divisor
b. The quotient
c. The dividend
d. The remainder *[1 mark]*

1.8 In cyclic redundancy checking, the divisor is _____ the CRC.

a. The same size as
b. one bit less than
c. one bit more than
d. none of the above *[1 mark]*

1.9 The Hamming distance between 100 and 001 is _____.

a. 2
b. 0 *[1 mark]*

c. 1
d. none of the above

1.10 A _____ is a connecting device that operates in the physical and data link layers of the Internet model.

a. repeater
b. bridge
c. router
d. none of the above *[1 mark]*

1.11 A _____ is normally a computer that operates in all five layers of the Internet model or seven layers of OSI model.

a. repeater
b. bridge
c. router
d. gateway *[1 mark]*

1.12 Change the following IP addresses from dotted decimal notation to binary notation:

a. 137.54.3.7 = 10001001 00110110 00000011 00000111

b. 214.34.27.33 = 11010110 00100010 00011011 00100001 *[2 marks]*

1.13 What is the default mask for class C in CIDR notation?

a. /24
b. /8
c. /16
d. none of the above *[1 mark]*

1.14 Identify the class of the following IPv4 address: 229.1.2.3.

a. A
b. B
c. D
d. none of the above *[1 mark]*

1.15 Which one is not a contiguous mask?

a. 255.255.255.254
b. 255.255.224.0
c. 255.148.0.0 = 11111111 10010100 00000000 00000000 **Not permitted as we must have all contiguous 1's with no intervening 0's**
d. all are *[1 mark]*

1.16 What is the principal difference between connectionless communication and connection-oriented communication?

ANSWER:
Connection-oriented: Set up and reserve resources along the path from source to destination. Must hodl these resources until completion of the communication,

Connection-less: Message can be passed from one node (Router) to the next without the need to reserve resources along the path from source to destination. Hence there is no direct connection involved. *[2 marks]*

1.17 ICMP is a _____ layer protocol.

a. data link
b. transport
c. network *[1 mark]*

d. none of the above

1.18 ICMP messages are divided into two broad categories: ____.

a) query and error reporting messages
b) request and response messages
c) request and reply messages
d) None of the above *[1 mark]*

1.19 The metric used by _____ is the hop count.

a. OSPF
b. RIP
c. BGP
d. none of the above *[1 mark]*

1.20 The _____ routing uses the Dijkstra algorithm to build a routing table.

a. distance vector
b. link state
c. path vector
d. none of the above *[1 mark]*

1.21 One of the responsibilities of the transport layer protocol is to create a _____ communication.

a. host-to-host
b. process-to-process
c. node-to-node
d. none of the above *[1mark]*

1.22 UDP is called a _____transport protocol.

a. connectionless, reliable
b. connection-oriented, unreliable
c. connectionless, unreliable
d. none of the above *[1 mark]*

1.23 The ports ranging from 49,152 to 65,535 can be used as temporary or private port numbers. They are called the _____ ports.

a. well-known
b. registered
c. dynamic
d. none of the above *[1 mark]*

1.24 A port address in UDP is _____bits long.

a. 8
b. 16
c. 32
d. any of the above *[1 mark]*

1.25 UDP packets have a fixed-size header of _____ bytes.

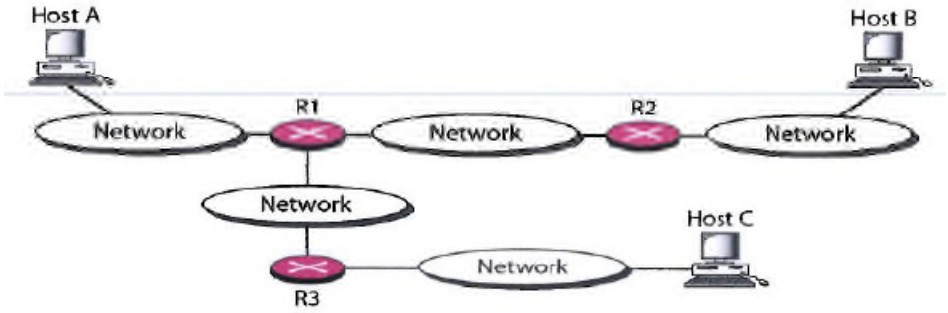
a. 16
b. 8
c. 40
d. none of the above *[1 mark]*

Total *[30 marks]*

Question 2 – More Detailed Answers Required

2.1 a. In a few sentences please explain the operation of the *traceroute* function used in IP networking?
b. On which **network layer** protocol does it rely?
c. On which **transport layer** protocol does it rely?

Answer:



a. The *traceroute* application at Host A sends a packet to destination B using UDP; the message is encapsulated in an IP packet with a TTL value of 1. We note the time that the packet is sent. Router R1 receives the packet. decrements the TTL and finds it is zero. It generates an ICMP message saying *time exceeded* and the packet is discarded. Host A sends a new packet with TTL equal to 2 and repeats the process. When it reaches the Host B, it finds that the UDP port is actually invalid for the UDP protocol and it sends back another ICMP message saying destination unreachable. This tells Host A that it reached the destination and no more packets need to be sent. The process terminates.

b. The network layer protocols used are **IP** and **ICMP** (mention one is enough)

c. The transport layer protocol is **UDP**

[4 + 1 + 1 = 6 marks]

2.2 An organisation is granted the block 16.0.0.0/8. The administrator wants to create 500 fixed length subnets.

a. Find the required subnet mask
b. Find the number of addresses in each subnet
c. Find the first and last allocatable addresses in subnet 1
d. Find the first and last allocatable addresses in subnet 500.

Answers:

a. $1og_2500 = 8.95$ so the number of extra **1s** = 9 Possible subnets: 512
Mask: /17 (8+9)

b. $2^{32-17} = 2^{15} = 32{,}768$ Addresses per subnet.

c. **Subnet 1:** The first address in this address is the beginning address of the block or 16.0.0_0. To find the last address, we need to write 32,767 (one less than the number of addresses in each subnet) in base 256 (0.0.127.255) and add it to the first address (in base 256):

First address in subnet 1: **16 . 0 . 0 . 0**
Number of addresses: **0 . 0 . 127. 255**
Last address in subnet 1: **16 . 0 . 127. 255**

[6 marks]

Last usable address: **16.0.127.254**

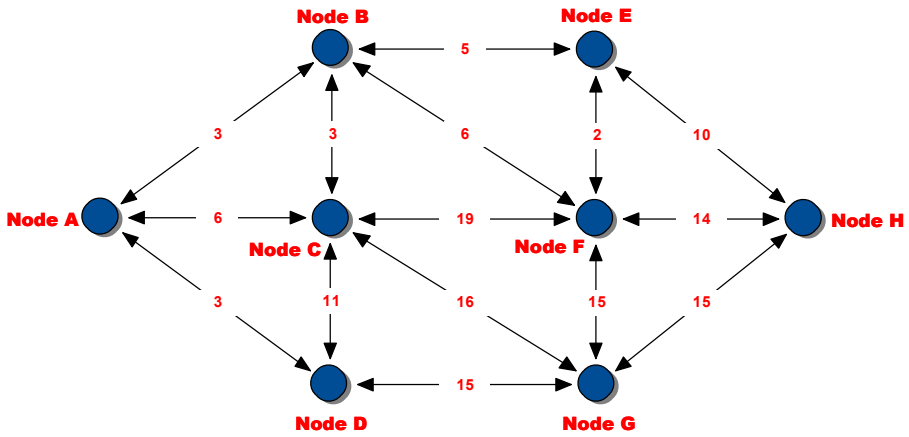
(Note some confusion over what is the first and the 500th subnet, generally accepted both interpretations.)

d. **Subnet 500:** Note that the subnet 500 is not the last possible subnet, it is the last subnet used by the organization. To find the first address in subnet 500, we need to add 16,351,232 (499 x 32678) in base 256 (0. 249.128.0) **to the first** address in subnet 1. We have 16.0.0.0 + 0.249.128.0 = **16.249.128.0.** Now we can calculate the last address in subnet 500.

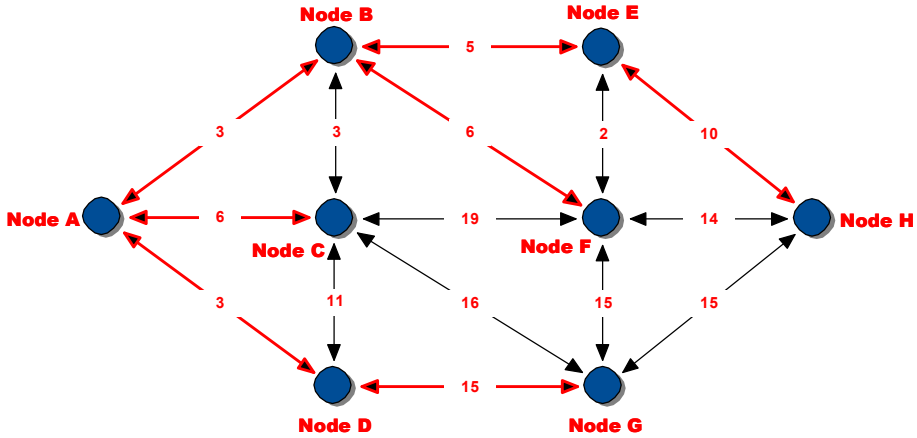
First address in subnet 500: **16 . 249. 128. 0**
Number of addresses: **0 . 0 . 127 . 255**
Last address in subnet 500: **16 . 249 . 255 . 255**

Last usable address: **16.249.255.254**

2.3 a. Apply the Dijkstra Shortest Path algorithm to the following network and determine the **shortest path tree assuming that the home node is Node A**? Show working with node labels as required.



Answer:



The tree is shown highlighted in red.

Minimum cost of path: Node A to Node D is = 3
Path:
Node A -> (Lk_Node A_Node D) -> Node D

[6 + 4 = 10 marks]

Minimum cost of path: Node A to Node C is = 6
Path:
Node A -> (Lk_Node A_Node C) -> Node C

Minimum cost of path: Node A to Node G is = 18
Path:
Node A -> (Lk_Node A_Node D) -> Node D -> (Lk_Node D_Node G) -> Node G

Minimum cost of path: Node A to Node H is = 18
Path:
Node A -> (Lk_Node A_Node B) -> Node B -> (Lk_Node B_Node E) -> Node E -> (Lk_Node E_Node H) -> Node H

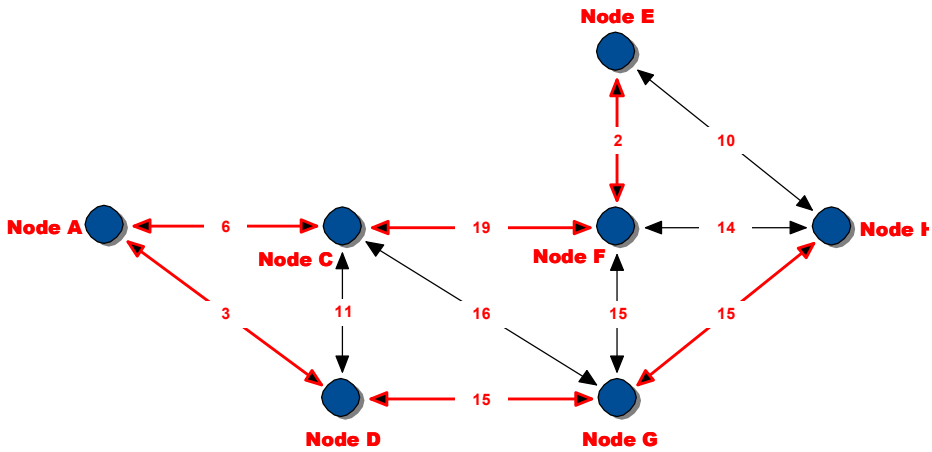
Minimum cost of path: Node A to Node E is = 8
Path:
Node A -> (Lk_Node A_Node B) -> Node B -> (Lk_Node B_Node E) -> Node E

Minimum cost of path: Node A to Node B is = 3
Path:
Node A -> (Lk_Node A_Node B) -> Node B

Minimum cost of path: Node A to Node F is = 9
Path:
Node A -> (Lk_Node A_Node B) -> Node B -> (Lk_Node B_Node F) -> Node F

b. If Node B should fail what is the path from home **Node A** to destination **Node H** and the cost of this path through the remaining working section of the network?

Answer:



The highlighted tree is given above (only need to show the path to Node H

Minimum cost of path: Node A to Node H is = 33
Path:
Node A -> (Lk_Node A_Node D) -> Node D -> (Lk_Node D_Node G) -> Node G -> (Lk_Node G_Node H) -> Node H

2.4 Change the following IP addresses from binary notation to dotted decimal notation:

a. 01111111 11110000 01100111 01111101
b. 10101111 11000000 11111000 00011101
c. 11011111 10110000 00011111 01011101
d. 11101111 11110111 11000111 00011101

Answers:

a. 127.240.103.125
b. 175.192.248.29
c. 223.176.31.93
d. 239.247.199.29

[8 marks]

Total *[30 marks]*