Benha University
Faculty of Engineering (at Shoubra)
Electrical Engineering Department
4th (Computer Engineering)

1.You should attempt ALL requested parts.
2. You should write your answers clearly.

Final-Term Examination Model Answer
Subject: Computer Networks - ECE413C
Date: Wed. 04/01/2017
Duration: 3 hour

№ of Questions: 4 in 7 page(s)
Total Mark: 75

Answer all questions: ***Be sure to write each question number and part number ahead of your answer***

Question No. 1: [20 Points]

1. In error reporting the encapsulated ICMP packet goes to _______.
- **a)** The receiver
- **b)** A router
- **c)** The sender
- **d)** Any of the above

2. An ARP request is _______ to _______.
- **a)** Multicast; one host
- **b)** Unicast; all hosts
- **c)** Broadcast; all hosts
- **d)** Unicast; one host

3. What is needed to determine the number of the last byte of a fragment
- **a)** Identification number
- **b)** Offset number
- **c)** Total length
- **d)** (b) and (c)

4. _______ is a dynamic mapping protocol in which a physical address is found for a given IP address.
- **a)** RARP
- **b)** ICMP
- **c)** ARP
- **d)** None of the above

5. A router reads the _______ address on a packet to determine the next hop.
- **a)** MAC
- **b)** Source
- **c)** IP
- **d)** ARP

6. The target hardware address on an Ethernet is _______ in an ARP request.
- **a)** Variable
- **b)** Class-dependent
- **c)** 0x000000000000
- **d)** 0.0.0.0

7. A datagram is fragmented into three smaller datagrams. Which of the following is true?
- **a)** The do not fragment bit is set to 1 for all three datagrams.
- **b)** The identification field is the same for all three datagrams.
- **c)** The more fragment bit is set to 0 for all three datagrams.
- **d)** The offset field is the same for all three datagrams

8. On a network that uses NAT, the _______ has a translation table.
- **a)** Router
- **b)** Switch
- **c)** Server
- **d)** None of the above

9. _______ is a client-server program that provides an IP address, subnet mask, IP address of a router, and IP address of a name server to a computer.
- **a)** NAT
- **b)** DHCP
- **c)** CIDR
- **d)** ISP

10. In _______, each packet of a message need not follow the same path from sender to receiver.
- **a)** The virtual approach to packet switching
- **b)** The datagram approach to packet switching
- **c)** Message switching
- **d)** None of the above

11. Dijkstra's algorithm is used to _______.

a) Create LSAs
b) Flood an internet with information
c) Create a link state database
d) Calculate the routing tables

12. RIP is based on ________.

a) Link state routing
b) Dijkstra's algorithm
c) Path vector routing
d) Distance vector routing

13. A ________ frame usually precedes a CTS frame.

a) SIFS
b) RTS
c) DIFS
d) Any of the above

14. The access method for wireless LANs as defined by IEEE 802.11 is based on _______.

a) Token passing
b) CSMA
c) CSMA/CD
d) CSMA/CA

15. A bridge has access to the ________ address of a station on the same network.

a) Network
b) Service access point
c) Physical (MAC)
d) All the above

16. If an Ethernet destination address is 08-07-06-05-44-33, then this is a _______ address.

a) Broadcast
b) Unicast
c) Multicast
d) Any of the above

17. In IPv4, what is the value of the total length field in bytes if the header is 28 bytes and the data field is 400 bytes?

a) 407
b) 107
c) 428
d) 427

18. On a network that uses NAT, ________ initiates the communication.

a) An internal host
b) An external host
c) The router
d) (a) or (b)

19. A bridge forwards or filters a frame by comparing the information in its address table to the frame's ________.

a) Source node's physical address
b) Layer 2 destination address
c) Layer 2 source address
d) Layer 3 destination address

20. Given the IP address 180.25.21.172 and the subnet mask 255.255.192.0, what is the subnet address?

a) 180.25.21.0
b) 180.25.8.0
c) 180.25.0.0
d) 180.0.0.0

Question No. 2: **[15 Points]**

1. **[5 points]** Six stations, A through F, communicate using the MACA protocol. Is it possible for two transmissions to take place simultaneously? Explain your answer.

   Yes. Imagine that they are in a straight line and that each station can reach only its nearest neighbors. Then A can send to B while E is sending to F.

2. **[5 points]** A network on the Internet has a subnet mask of $255.255.240.0$. What is the maximum number of hosts it can handle?

   The mask is 20 bits long, so the network part is 20 bits. The remaining 12 bits are for the host, so 4096 host addresses exist.

3. [**5 points**] A router has just received the following new IP addresses: $57.6.96.0/21$, $57.6.104.0/21$, $57.6.112.0/21$, and $57.6.120.0/21$. If all of them use the same outgoing line, can they be aggregated? If so, to what? If not, why not?

   They can be aggregated to $57.6.96.0/19$.

Question No. 3: **[20 Points]**

1. **[4 Points]** Suppose that host A is connected to a router $R\ 1$, $R\ 1$ is connected to another router, $R\ 2$, and $R\ 2$ is connected to host B. Suppose that a TCP message that contains 900 bytes of data is passed to the IP code at host A for delivery to B, Ignore length of headers . Show the **Total length**, **Identification**, **DF**, **MF**, and **Fragment offset fields** of the IP header in each packet transmitted over the three links. Assume that link $A - R1$ can support a maximum frame size of 1024 bytes , link $R1 - R2$ can support a maximum frame size of 512 bytes, and link $R2 - B$ can support a maximum frame size of 512 bytes.

Link *A-R1*:

Length = 940; *ID* = x; *DF* = 0; *MF* = 0; *Offset* = 0

Link *R1-R2*:

(1) *Length* = 500; *ID* = x; *DF* = 0; *MF* = 1; *Offset* = 0

(2) *Length* = 460; *ID* = x; *DF* = 0; *MF* = 0; *Offset* = 60

Link *R2-B*:

(1) *Length* = 500; *ID* = x; *DF* = 0; *MF* = 1; *Offset* = 0

(2) *Length* = 460; *ID* = x; *DF* = 0; *MF* = 0; *Offset* = 60

2. **[5 Points]** A large number of consecutive IP addresses are available starting at $198.16.0.0$. Suppose that four organizations, $A, B, C,$ and D, request $4000, 2000, 4000,$ and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the $w.x.y.z/s$ notation.

To start with, all the requests are rounded up to a power of two. The starting address, ending address, and mask are as follows:

A : $198.16.0.0$ – $198.16.15.255$ **written as** $198.16.0.0/20$

B : $198.16.16.0$– $198.16.23.255$ **written as** $198.16.16.0/21$

C : $198.16.32.0$ – $198.16.47.255$**written as** $198.16.32.0/20$

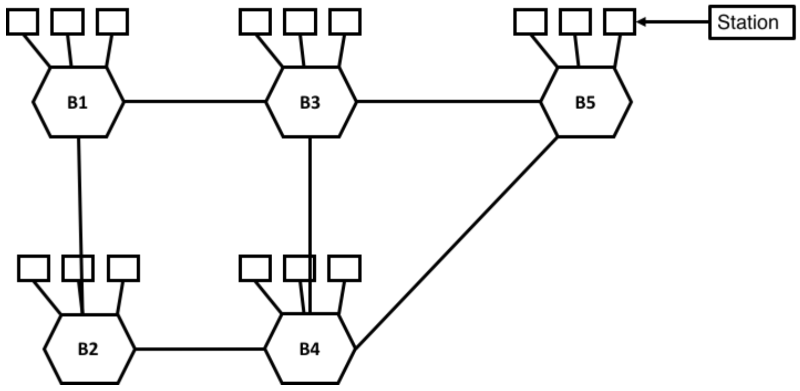
D : $198.16.64.0$ – $198.16.95.25$5 **written as** $198.16.64.0/19$

3. **[5 Points]** In the Fig. below, we see five bridges (Switches) that are interconnected and also have stations connected to them. Each station connects to only one bridge. There are some redundant connections between the bridges so that frames will be forwarded in loops if all of the links are used. The graph can be reduced to a spanning tree, which has no cycles by definition, by dropping some links. ***Show step by step, how to compute the spanning tree for that graph***. You must show:

a) Where the root node.

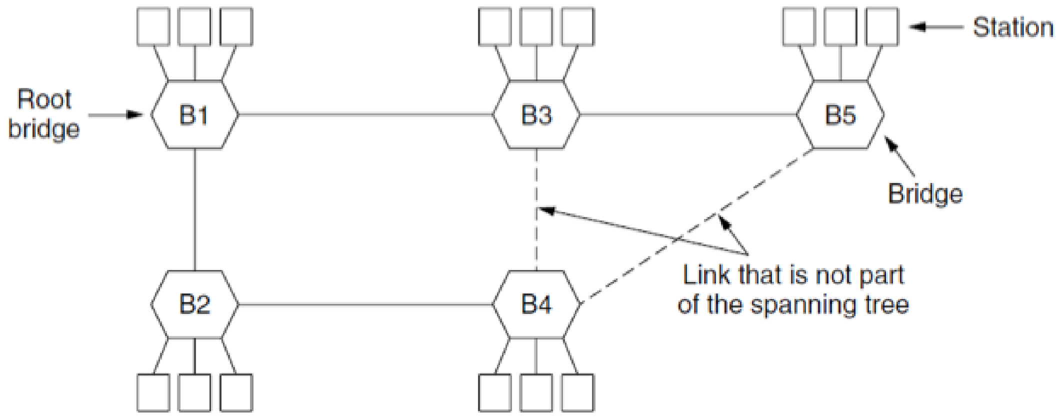
b) The dashed lines which are the links that not part of the spanning tree.

Note: MAC B1< MAC B2< MAC B3< MAC B4< MAC B5



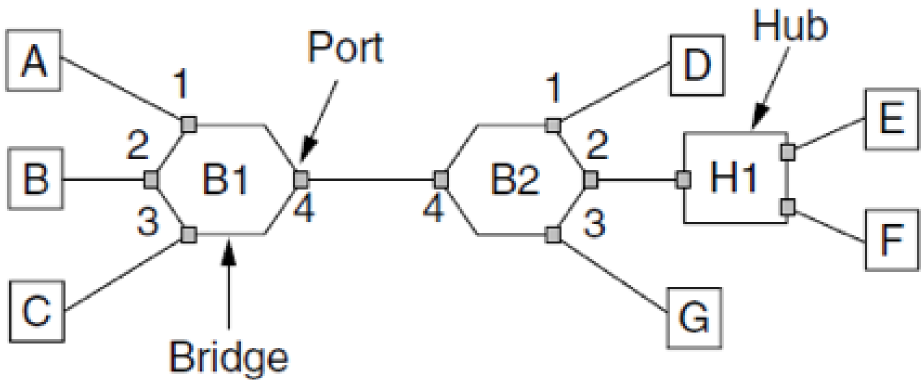
After the algorithm runs:

- B1 is the root, two dashed links are turned off
- B4 uses link to B2 (lower than B3 also at distance 1)
- B5 uses B3 (distance 1 versus B4 at distance 2)



4. **[6 Points]** Consider the extended LAN connected using bridges (Switches) B1 and B2 in the following Fig. Suppose the hash tables in the two bridges are empty. List all ports on which a packet will be forwarded for the following sequence of data transmissions:
   - **a)** A sends a packet to C.
   - **b)** E sends a packet to F.
   - **c)** F sends a packet to E.
   - **d)** G sends a packet to E.
   - **e)** D sends a packet to A.
   - **f)** B sends a packet to F.

   Hint: use Backward Learning Algorithm



(a) *B1* will forward this packet on ports 2, 3, and 4. *B2* will forward it on 1, 2 and 3.
(b) *B2* will forward this packet on ports 1, 3, and 4. *B1* will forward it on 1, 2 and 3.
(c) *B2* will not forward this packet on any of its ports, and *B1* will not see it.
(d) *B2* will forward this packet on port 2. *B1* will not see it.
(e) *B2* will forward this packet on port 4 and *B1* will forward it on port 1.
(f) *B1* will forward this packet on ports 1, 3 and 4. *B2* will forward it on port 2.

Question No. 4: **[15 Points]**

1. **[5 Points]** A router has the following (CIDR) entries in its routing table:

Address/mask	**Next hop**
135.46.56.0/22	Interface 0
135.46.60.0/22	Interface 1
192.53.40.0/23	Router 1
default	Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?

a) 135.46.63.10

b) 135.46.57.14

c) 135.46.52.2

d) 192.53.40.7

e) 192.53.56.7

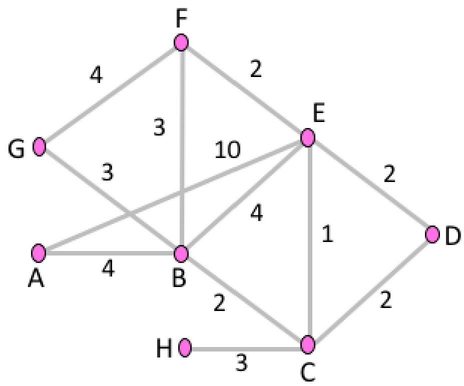
The packets are routed as follows:

(a) Interface 1
(b) Interface 0
(c) Router 2
(d) Router 1
(e) Router 2

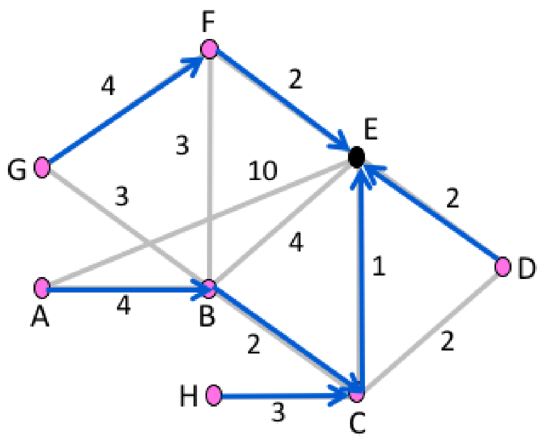
2. **[5 Points]** In the following network topology.

a) find and draw the sink tree for **E**, given the following network topology.

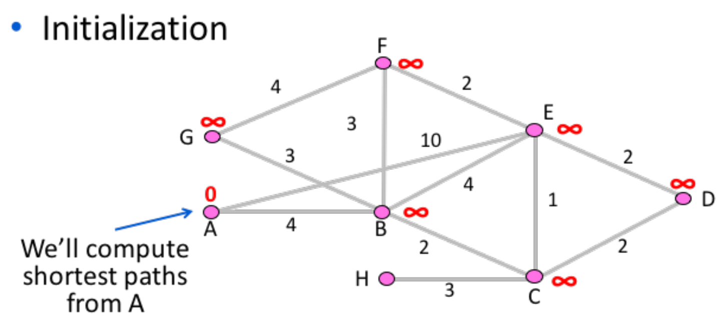
b) Show step by step, how to compute source tree for **A**, given the following network topology using Dijkstra's algorithm.

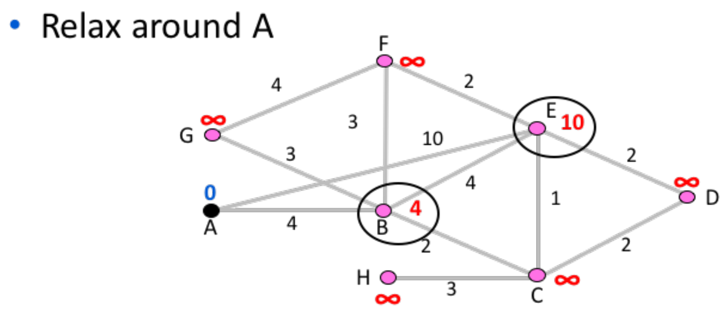


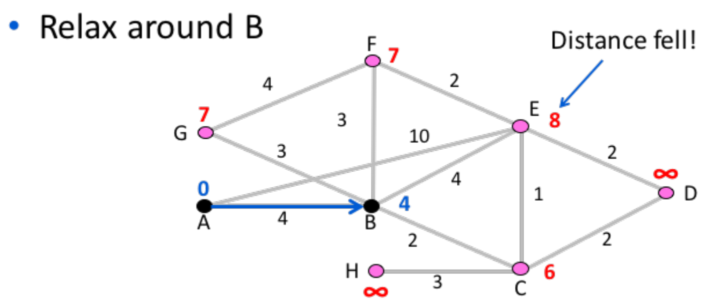
a) The sink tree for **E**

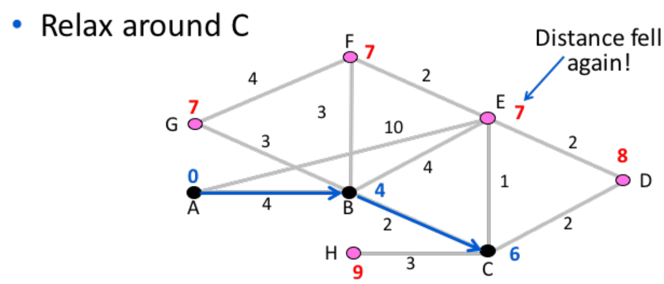


b) The source tree for **A**, using Dijkstra's algorithm.

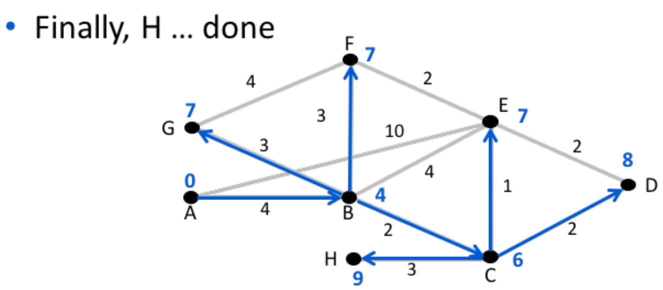








Relax around G (say), F (say), E, D

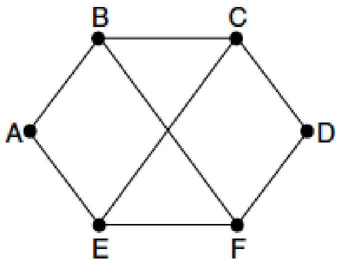


3. **[4 points]** Most IP datagram reassembly algorithms have a timer to avoid having a lost fragment tie up reassembly buffers forever. Suppose that a datagram is fragmented into four fragments. The first three fragments arrive, but the last one is delayed. Eventually, the timer goes off and the three fragments in the receiver's memory are discarded. A little later, the last fragment stumbles in. What should be done with it?

As far as the receiver is concerned, this is a part of new datagram, since no

other parts of it are known. It will therefore be queued until the rest show up. If they do not, this one will time out too.

4. **[6 Points]** Consider the network of the following Fig. Distance vector routing is used, and the following vectors have just come in to router C: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10); and from E: (7, 6, 3, 9, 0, 4). The cost of the links from C to B, D, and E, are 6, 3, and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the cost.



Going via B gives (11, 6, 14, 18, 12, 8).
Going via D gives (19, 15, 9, 3, 12, 13).
Going via E gives (12, 11, 8, 14, 5, 9).

Taking the minimum for each destination except C gives (11, 6, 0, 3, 5, 8).
The outgoing lines are (B, B, –, D, E, B).