**1: A packet has arrived with an MF bit value of zero, and the fragmentation offset value is non-zero. This is the _____.?**

A) First fragment B) Last fragment

C) Middle fragment D) No fragment

Answer:(B)
Explanation:

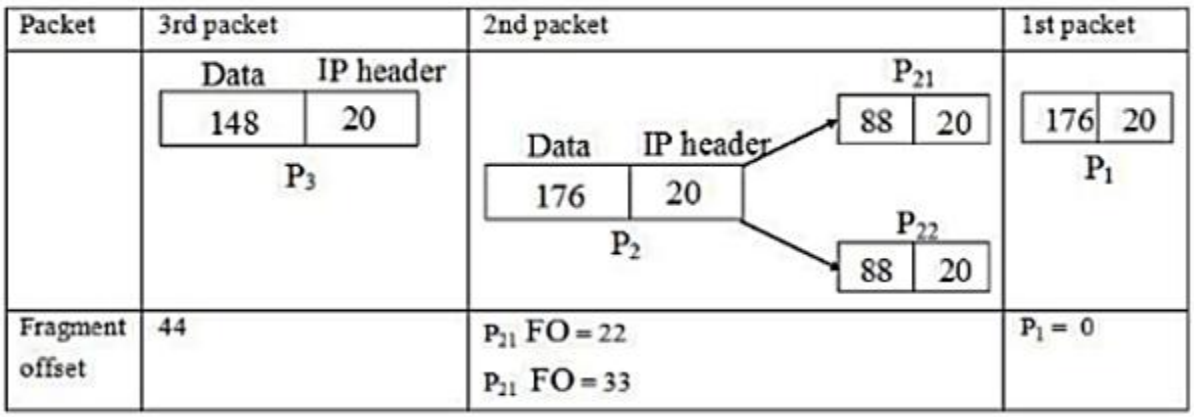
MF = 0 Offset = 0 => No fragment
MF = 0 Offset = !0 => Last fragment
MF = 1 Offset = 0 => First fragment
MF = 1 Offset = !0 => Intermediate fragment

**2: A message consisting of 500 bytes is passed to the IP for delivery to the destination. The first network can carry an MTU of 200 bytes. The second packet takes a different path with an MTU of 110 bytes. Assume that the IP overhead per packet is 20 bytes. What is the fragment offset for the third packet received by the destination?**

A) 22 B) 33

C) 44 D) 88

Answer:(B)
Explanation:
176 + 176 + 148 = 500



**3: A Router with an MTU of 1024 bytes has received an IP packet of size 4240 bytes with an IP header of 20 bytes. The value of MF and offset of the 3rd fragment is____?**

A) MF = 0, OFFSET = 125

B) MF = 1, OFFSET = 125

C) MF = 1, OFFSET = 250

D) MF = 1, OFFSET = 375

Answer:(C)
Explanation:

IP packet size 4240 bytes.
MTU = 1024 bytes.
DATA = MTU - header = 1024 - 20 = 1004
1004 is not divisible by 8, so take only 1000

| Fragment | MF | Offset | Length | |
|---|---|---|---|---|
| I | 1 | 0 | 1000 | |
| II | 1 | 125 | 1000 | |
| III | 1 | 250 | 1000 | => 2000/8 = 250 (offset value) |
| IV | 1 | 375 | 1000 | |
| V | 0 | 500 | 240 | |

**4: Consider an IP link with a maximum transfer unit of 700 bytes, and each datagram size to send is 2400 bytes. Assume that the datagram recently sent has an identification number of 422. What is the total number of fragments that must be sent to transfer the full datagram, and what is the offset value of the 2nd fragment from all the fragmented datagrams. ? Note: Consider the minimum header size of the IPV4 datagram.**

A) 4, 680

B) 4, 170

C) 1, 0

D) 4, 85

Answer:(A,B,C)
Explanation:

The Maximum transfer Unit = 700 bytes, Each datagram size = 2400 bytes
2400 bytes = 2380 bytes data + 20 bytes header
Then, the datagram divides into multiple frames depending on MTU
680 bytes data + 20 bytes header → fragment 1
680 bytes data + 20 bytes header → fragment 2
680 bytes data + 20 bytes header → fragment 3
360 bytes data + 20 bytes header → fragment 4
⇒ Total number of fragments = 4
Offset is the number of data bytes ahead of the particular fragment.
⇒ Offset value of 2nd fragment is 680/8 = 85 bytes

**5. Host A sends a UDP datagram containing 8880 bytes of user data to host B over an Ethernet LAN. Ethernet frames may carry data up to 1500 bytes (i.e. MTU = 1500 bytes). The size of the UDP header is 8 bytes, and the size of the IP header is 20 bytes. There is no option field in the IP header. How many IP fragments will be transmitted, and what will be the contents of the offset field in the last fragment?**

A. 6 and 925
B. 6 and 7400
**C. 7 and 1110**
D. 7 and 8880

**Answer:(C)**
**Explanation:**

UDP data = 8880 bytes, UDP header = 8 bytes, IP Header = 20 bytes
Total Size excluding IP Header = 8888 bytes.
Number of fragments = ceil(8880+ UDP or TCP header /1500-IP header)
= ceil(8880+8 /1500-20)
= ceil(8888/1480) = 7
The offset of the last fragment = (MTU-IP header ) x ( number of fragments -1) / scaling factor = 1110 (scaling factor of 8 is used in offset field).
=(1500-20) x (7-1)/8 =1110

**6. Two popular routing algorithms are Distance Vector routing (DVR) and Link State Routing (LSR) routing. Which of the following is true? [MSQ]**

A. **Count-to-infinity is a problem only with DVR, not in LSR**.
B. In LSR, the shortest path algorithm is run only at one node.
C. In DVR, the shortest path algorithm runs only at one node.
**D. DVR requires a lesser number of messages than LSR.**

**Answer:(A,D)**
**Explanation:**

True - Count-to-infinity is a problem only with DVR, not in LSR.
False - In LSR, all nodes have a shortest path tree; thus, the shortest path algorithm is run on all nodes.
False - In DVR, the bellman shortest path algorithm runs only at all nodes.
True - DVR requires fewer numbers of messages than LSR because nodes share distance vectors only with their neighbouring nodes; instead, in LSR, all nodes flood the Link state information to all nodes in the network.

**7. Which of the following is TRUE? [MSQ]**

**A. Link State Routing algorithm uses Dijkstra shortest path algorithm**
B. Link State Routing algorithm uses Bellman ford algorithm.
C. Persistent Loops are not created using Distance Vector Routing Algorithm.
**D. Split horizon eliminates persistent loops in Distance Vector Routing algorithm.**

**Answer: (A, D)**
**Explanation:**

A. **True**, Dijkstra shortest path algorithm is used in Link State Routing for finding the shortest path tree at each node.
B. **False,** Link State Routing algorithm does not use Bellman ford algorithm; instead, it uses Dijkstra shortest path algorithm.
C. **False**, In DVR, it has a count infinity problem, which creates persistent loops.
D. **True,** to solve the count-to-infinity problem, a split horizon is used in DVR.

**8. Which of the following is/are TRUE? [MSQ]**

**a. Flooding guarantees the shortest path.**
**b. In LSR(*link state routing*), flooding is used by nodes to send Link state information to all the nodes in the network.**
c. Flooding Link State Packets create persistent loops in the network.
**d. In OSPF, hello messages are used by nodes to know their neighbouring nodes.**

**Answer:(A,B,D)**
**Explanation:**

A. **True,** Every node in the network will send the incoming packet into all interfaces other than the interface of the incoming packet. So, the shortest path is guaranteed.
**B. True.** In LSR, flooding is used to link state information.
C. **False.** In OSPF, due to flooding, temporary loops may be formed but terminated after some time.
**D. True,** OSPF nodes send hello packets to know the neighbouring nodes.

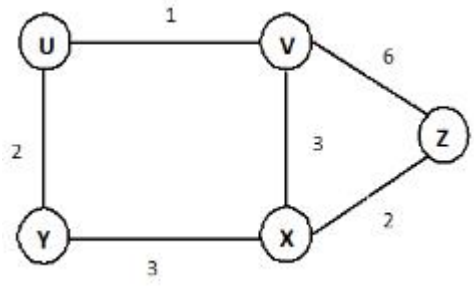
**9. Which of the following is/are TRUE? [MSQ]**

a. **Acknowledgements to Link state update packets make OSPF more reliable.**
b. **OSPF packets are encapsulated in IP datagrams.**
c. **In LSR, every node generates a shortest path tree for each node.**
d. The main purpose of TTL in LSR packets is to ensure the shortest path.

**Answer:(A,B,C)**
**Explanation:**

A. **True,** OSPF makes routing more reliable by forcing every router to acknowledge the receipt of every link state update packet.
**B. True,** OSPF packets are encapsulated in IP datagrams. They contain the acknowledgement mechanism for flow and error control. They do not need a transport layer protocol to provide these services.
**C. True,** In LSR, every node generates a shortest path tree for each node.
**D. False,** TTL is used to ensure the termination of permanent loops.

**10. Consider the network shown below; what would be the distance vector at Z when all the routers converge?**




a. u v x y z
   6 5 2 4 0
b. u v x y z
   6 4 2 5 0
c. u v x y z
   6 4 2 4 0
**d. u v x y z**
   **6 5 2 5 0**

**Answer:(D)**
**Explanation:**

Check each node's distance to Z by applying the shortest path algorithm.
Then the distances from Z are, z -> u = min [(zv + vu), (zx + xv + vu), (zx + xy + yu), (zv, + vx + xy + yu)] = 6

Then the distances from Z are, z -> v = min [(zv), (zx + xv), ( zx+xy + yu+uv)] = 5

Then the distances from Z are, z -> x = min [(zx), (zv + vx), (zv + vu + uy +yx)] = 2

Then the distances from Z are, z -> y = min [(zv + vu+uy), (zv + vx + xy), (zx + xy), (zx + xv + vu+uy)] = 5
Then the distances from Z are z -> z = 0

Do this procedure for all the nodes.
Then the answer will be 6, 5, 2, 5, 0

**11. Consider an IP packet with a length of 4,500 bytes that includes a 20-byte IPv4 header and a 40-byte TCP header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the outgoing fragments of this packet is 20 bytes. Assume that the fragmentation offset value stored in the first fragment is 0. The fragmentation offset value stored in the third fragment is _____.**

- **A. 144**
- B. 145
- C. 146
- D. 147

**Answer:(A)**
**Explanation:**

MTU = 600 bytes, IP header = 20 bytes
Therefore Payload = 600 - 20 = 580 bytes.
As we know, fragment size should be a multiple of 8, but 580 bytes is not a multiple of 8.
Therefore, the fragment size is 576 bytes.
Offset value of $k^{th}$ fragment = Fragment size x ( $k^{th}$ fragment - 1) / scaling factor.
Offset value of third fragment = 576 x (3-1) / 8 = 144

**12. Consider the following three statements about link state and distance vector routing protocols for a large network with 500 network nodes and 4000 links.**

[S1] The computational overhead in link state protocols is higher than in distance vector protocols.
[S2] A distance vector protocol (with a split-horizon) avoids persistent routing loops but not a link-state protocol.
[S3] After a topology change, a link-state protocol will converge faster than a distance vector protocol.

Which of the following is correct about S1, S2, and S3?

A. S1, S2, and S3 are all true.
B. S1, S2, and S3 are all false.
C. S1 and S2 are true, but S3 is false.
D. S1 and S3 are true, but S2 is false

Answer:(D)
Explanation:

S1: The computational overhead in link state protocols is higher than in distance vector protocols. Because LSR is based on global knowledge, whereas DVR is based on local information. (True)
S2: A distance vector protocol with a split-horizon to avoid persistent routing loops is true, but not a link-state protocol is false because link-state protocols do not have a count-to-infinity problem.
S3: As the distance vector protocol has a count-to-infinity problem, it converges slower. (True)

**12.. Which of the following is TRUE about the interior gateway routing protocols – Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)?**

A. RIP uses distance vector routing, and OSPF uses link state routing
B. OSPF uses distance vector routing, and RIP uses link state routing
C. Both RIP and OSPF use link-state routing
D. Both RIP and OSPF use distance vector routing

Answer: (A)
Explanation:

RIP Uses Distance Vector Routing, and OSPF uses Link State Routing.

**13. What are all the fields required from the IP header to allow the destination to perform the reassembly of fragments?[MSQ]**

A) Identification B) MF, Offset

C) Header length D) Total length

Answer:(A, B, C, D)
Explanation:

All the fields are required to perform Reassembly.

**14. The checksum in IP must be recomputed at every router because of changes in ____ fields.[MSQ]**

A) TTL B) Options C) Datagram Length D) Offset

Answer:(A,B,C,D)
Explanation:

Because of all the field changes, the checksum in IP must be recomputed for every router.

**15: The checksum computation in the IP header includes____?**

A) IP header only B) IP header and data

C) IP header and Pseudo header D) None of these

Answer:(A)
Explanation:

Checksum computation in the IP header includes the IP header only.
The encapsulated protocol handles errors in the data field.
Thus, Option (A) is correct.