**important points about Fragments**

* To identify that datagram is fragmented or not look at( M bit, offset), M bit 1 and offset other than 0 means data gram is fragmented
* To identify that all fragments belongs to the same datagram look to Identification (ID field of all fragments are same
* To Identify the first fragment, check offset value (offset =0 for first fragment)
* To get details of the subsequent fragments look to (TL,HL, offset)
* To find the first byte of fragment, look to offset value and multiple it with 8, the resultant value is first byte
* To identify that the last fragment check the M bit value ( if M=0 then this is the last fragment)

**Question: A datagram is carrying 1024 bytes of data. If there is no option information, what is the value of the header length field? What is the value of the total length field?**

**Solution:**

Given, Data-size = 1024 bytes.

=> Header-size = 20 bytes (since no option bytes present)

therefore, HLEN = 20/4 = 5.

Total length of datagram = 1024 + 20 = 1044 bytes

**Question: A host is sending 100 datagrams to another host. If the identification number of the first datagram is 1024, what is the identification number of the last?**

**Solution**

Since Identification numbers are given in sequence

=> the identification of last datagram = 1024+99 = 1123

**Question: A datagrams is divided into 10 fragments. if the identification number of first fragment is 2091 then what is the identification number of the last fragment?**

**Solution**

Since Identification numbers for all fragments remain same

=> the identification of last fragment = 2091

**Question: In an IP packet, the value of HLEN is 616 and the value of the total length field is 003816. How many bytes of data are being carried by this packet?**

**Solution**: The HLEN value is 4, it means HLEN in decimal is => 6X160 = 6, therefore, Header-size = 6 X 4 = 24 bytes

Given => Total length is 003816, it means length in decimal

=> 3X161+8X160= 48+8 = 56 bytes [Total length = Header + Data]

Data = Total length - Header => 56-24 = 32 bytes

**Question: A datagram of size 824 bytes has arrived in which the offset value is 100. What is the number of the first byte and last byte? (Given HLEN=6)**

**Solution**

Given => HLEN = 6 => header-size= 6X4= 24 bytes

=> Datagram size = 820 bytes, therefore data-size = 824-24 = 800 bytes

=> offset = 100, therefore first byte = 100X8 = 800

since the data-size is 800 bytes=>last byte = 1599

**Question: Calculate the HLEN value if the total length is 1200 bytes, 1176 of which is data from the upper layer.**

**Solution:**

Given Total length = 1200 bytes

=> Data-size = 1176 bytes (upper-layer data will be data-size in datagram)

=> Header-size = 1200 - 1176 = 24 bytes

Therefore, HLEN = 24/4 = 6

**Question: An IP packet of size 1600 bytes passes through network segment before it reaches its destination. The header size of this packet is 30 bytes. The maximum size of an IP packet in intermediate network (MTU) is 1400 bytes. How the IP packet would be fragmented in a router. Find all the information for each fragment.**

**Solution**

Packet size = 1600 B => 30 + 1570

Given MTU is 1400 bytes => Permitted Pkt size = 30 + 1370 => 1400 bytes

Since 1370 is not multiple of 8, therefore feasible data-size is = 1368

=> So total data-bytes (1570) is fragmented as 1368 + 202 bytes

First Fragment

Packet Size = 30 + 1368 = 1398 bytes [header = 30 bytes, data = 1368 bytes]

Bytes Range = 0000 to 1367

M bit = 1

offset = 0000/8 = 0

Second Fragment

Packet Size = 30 + 202 = 232 bytes [header = 30 bytes, data = 232 bytes]

Bytes Range = 1368 to 1569

M bit = 0

offset = 1368/8 = 171