GATE

Computer Science & Information Technology

Computer Networks-1

DPP: 1

IPV4 Header

Q1 Identify valid IPv4 packet starting bits.
(A) 01010100 (B) 01010101
(C) 01000100 (D) 01000101

Q2 Consider initial bits of an IPv4 packet are "01000111", calculate header size (in bytes)?

Q3 Consider initial bits of an IPv4 packet are "01001110", calculate options (optional header) size (in bytes)?

Q4 Consider an IPv4 packet with the value of HLEN (header length) field is 5, and the value of the total length field is 879. How many bytes of data the packet is carrying in its payload field?

Q5 Consider UDP segment of size 2000 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 20 bytes. How many total number of IP fragments required to transmit the UDP segment ?

Q6 Consider UDP segment of size 2000 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 20 bytes. Calculate size of the last fragment in bytes after fragmentation ?

Q7 Consider UDP segment of size 2000 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 20 bytes. Calculate offset value of the last fragment after fragmentation ?

Q8 Consider UDP segment of size 1540 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 40 bytes. How many total number of IP fragments required to transmit the UDP segment ?

Q9 Consider UDP segment of size 1540 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 40 bytes. Calculate size of the last fragment in bytes after fragmentation ?

Q10 Consider UDP segment of size 1540 bytes is passed to IP for delivery. MTU (maximum transmission unit) for source network is 300 bytes and IPv4 header size is 40 bytes. Calculate offset value of the last fragment after fragmentation ?

Q11 Consider an IPv4 datagram of size 3000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 500 bytes. Assume that the size of the IP header is 20 bytes. How many total number of IP fragments required to transmit the UDP segment ?

Q12 Consider an IPv4 datagram of size 3000 bytes arrives at a router. The router has to forward this

packet on a link whose MTU (maximum transmission unit) is 500 bytes. Assume that the size of the IP header is 20 bytes. Calculate size of the last fragment in bytes after fragmentation ?

Q13 Consider an IPv4 datagram of size 3000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 500 bytes. Assume that the size of the IP header is 20 bytes. Calculate offset value of the last fragment after fragmentation ?

Q14 Consider a UDP segment consisting of 3000 bytes is passed to IP for delivery across two networks. The first network can carry a maximum payload of 2000 bytes per datagram and the second network can carry a maximum payload of 1000 bytes per datagram, excluding network overhead. How many total number of IP fragments in the second network for this transmission?

Q15 Time-to-live (TTL) field in IPv4 header is used to prevent _____ .
(A) Collision of packets.
(B) Fragmentation of packet
(C) Indefinite traversing of packets
(D) Retransmission of packets.

Q16 The TTL (time-to-live) field of an IPv4 datagram is 3, how many hops can this packet travel before being dropped ?
(A) 1 hop (B) 2 hops
(C) 3 hops (D) 4 hops

Q17 In the TCP/IP protocol suite, which one of the following is NOT part of the IPv4 header?
(A) Source IP Address
(B) Destination IP Address
(C) Source Port Number
(D) Destination Port Number

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Answer Key

Q1	(D)
Q2	28~28
Q3	36~36
Q4	859~859
Q5	8~8
Q6	60~60
Q7	245~245
Q8	6~6
Q9	300~300
Q10	160~160
Q11	7~7
Q12	120~120
Q13	360~360
Q14	3~3
Q15	(C)
Q16	(C)
Q17	(C, D)

Hints & Solutions

Q2 Text Solution:

HLEN = $(0111)_2$ = 7 words

Header size = (HLEN × 4) byte

= 7 × 4 = 28 byte

Q3 Text Solution:

HLEN = $(1110)_2$ = 14 words

Base Header size = 5 words

Options size = (HLEN – 5) words

= 14 – 5 = 9 words

= 9 × 4 bytes = 36 bytes

Q4 Text Solution:

HLEN = 5 words

TL = 879 bytes

Payload size = [TL – (HLEN × 4)] bytes

= [879 – (5 × 4)] = 859 bytes

Q5 Text Solution:

UDP segment size = 2000 bytes

MTU = 300 bytes

Header size = 20 bytes

Payload size = [MTU – Header size]

= 300 – 20 = 280 bytes

No. of IP fragments (N) $= \left\lceil \frac{\text{UDP segment size}}{\text{Payload size}} \right\rceil$

$= \left\lceil \frac{2000 \text{ bytes}}{280 \text{ bytes}} \right\rceil = \lceil 7.14 \rceil = 8$

Q6 Text Solution:

Total length of last fragment

= Header size + [UDP segment size – (N – 1) × Payload size]

= 20 byte + [2000 – (8 – 1) × 280] bytes

= 20 + 40 = 60 bytes

Q7 Text Solution:

Offset value at last fragment

$= \left\lfloor \frac{(N-1) \times \text{Payload size}}{8} \right\rfloor$

$= \left\lfloor \frac{(8-1) \times 280 \text{ bytes}}{8} \right\rfloor = 245$

Q8 Text Solution:

UDP segment size = 1540 bytes

MTU = 300 bytes

Header size = 40 bytes

Payload size = MTU – Header size

= 300 – 40 = 260 bytes

(Not Multiple of 8 bytes)

= 256 bytes

No. of IP fragments (N) $= \left\lceil \frac{\text{UDP Segment size}}{\text{Payload size}} \right\rceil$

$= \left\lceil \frac{1540 \text{ bytes}}{256 \text{ bytes}} \right\rceil = \lceil 6.01 \rceil$ ✗

No. of UDP byte remain after 5 fragment

= UDP segment size – 5 × Payload size

= 1540 – 5 × 256 = 260 bytes

N = 6

Q9 Text Solution:

Total length of last fragment

= Header size + [UDP segment size – (N – 1) × Payload size]

= 40 bytes + [1540 – (6 – 1) × 256] bytes

= (40 + 260) bytes = 300 bytes

Q10 Text Solution:

Offset value of last fragment

$= \left\lfloor \frac{(N-1) \times \text{Payload size}}{8} \right\rfloor = \left\lfloor \frac{(6-1) \times 256 \text{ bytes}}{8} \right\rfloor$

$= 160$

Q11 Text Solution:

TL = 3000 bytes

Header size = 20 bytes

Old Payload size = TL – Header size

= 3000 – 20 = 2980 bytes

MTU = 500 bytes

New Payload size = MTU – Header size

= 500 – 20 = 480 bytes

No. of IP fragments (N) $= \left\lceil \frac{\text{Old payload size}}{\text{New payload size}} \right\rceil$

$$= \left\lceil \frac{2980 \text{ bytes}}{480 \text{ bytes}} \right\rceil = \lceil 6.20 \rceil$$

N = 7

Q12 Text Solution:

Total length of last fragments

= Header size + [Old payload size – (N – 1) × New Payload size]

= 20 bytes + [2980 – 6 × 480] bytes

= (20 + 100) bytes = 120 bytes

Q13 Text Solution:

Offset value for last fragment

$$= \text{Old offset} + \left[\frac{(N-1) \times \text{New Payload size}}{8} \right]$$

$$= 0 + \left[\frac{(7-1) \times 480 \text{ bytes}}{8} \right] = 360$$

Q14 Text Solution:

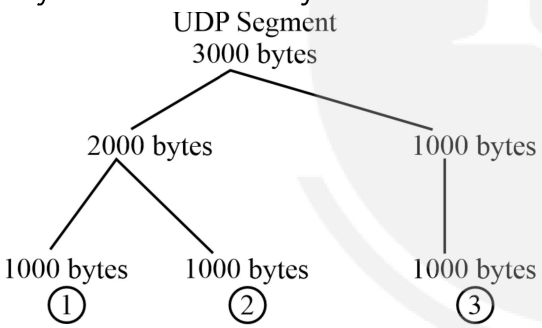
UDP segment size = 3000 bytes

1st Network :

Payload size 1 = 2000 bytes

2nd Network :

Payload size 2 = 1000 bytes



Q16 Text Solution: