Answer to the Ques. No-1

1(a)

2, 1, 6, 4, 5, 3, 7

~~1~~(b)

~~256 MB, 8 chunk~~

1(c)

access link = 123 mbps

LAN link = 1023 mbps

Server uploads 40 objects each 4 bytes

per second. $= 40 \times 4 = 160$ bytes/sec

$$= 160 \times 8 = 1280 \text{ bits/sec}$$

$$= 0.00128 \text{ Mbps}$$

Access link utilization $= (0.00128/123) \times 100\%$

$$= 0.00104\%$$

LAN utilization $= (0.00128/1023) \times 100\%$

$$= 0.000125\%$$

The utilization percentage is very small, so adding a proxy server will not help.

1(α)

If we delete the 'date' field in the HTTP Roponse/Request header, there will be problems in caching, logging & security issues.

Caches use the 'date' field in the HTTP header to determine how long to wait before refreshing/reloading. If the date field is removed, there will be no synchronization in caching. Also removing the 'date' field may result in problems in session control.

Proxy server reduce response time for a client despite visiting the origin server on every request it gets by reusing persistent TCP/TLS connection to the origin, pipelining or multiplexing requests to the origin, reducing RTT.

Answer to the Ques. No-2

2(a)

When viewing email using a very slow internet, IMAP is better suited.

If IMAP is used, we can read/view the message/email in part before we download the whole email. But if POP3 is used, we can read/view the message/email once it has been downloaded. So in case of a very slow internet connection, IMAP is better suited to view emails than POP3.

2(b)

Previous data is saved because cookie is used.

Cookie is used to maintain information about past client request. It permits sites to learn about clients. It can be used for authorization purposes, used in storing shopping carts, recommendations by websites/servers & for storing user session state (web email).

When items are added in the cart, the

website stores certain information about the user & the items stored in the cart, ~~which was the which can be seen~~ which is the same as when items are selected to keep in the cart in daraz, and when one revisits the site loads the saved data, which is saved as long as we do not clear cookies or the session expires.

2(c)

TTL: (time to live)

cached information has a lifespan (TTL) & removed from the cache after this time, requiring a fresh lookup.

(i) Nonte's cache expires at: $15:30_{\pm}$ pm, Phonte visits at : 15:00 pm, so the local DNS server still has the cached IP.

$$\therefore RTT = 2 \times 44 \, ms = 88 \, ms$$

2(c)(ii)

$$\text{server-client RTT} = 2 \times 89 = 178 \text{ ms}$$

$$\therefore \text{ per object RTT cost} = 2 \times 178 = 556 \text{ ms}$$

As there are 28 objects, total RTT cost

$$= 28 \times 356 = 9,968 \text{ ms}$$

$$\text{Total RTT time} = 88 + 9,968 \text{ ms}$$

$$= 10,056 \text{ ms}$$

2(c)(iii)

Total time $= 19988$ ms

$$RTT = 10056 \text{ ms}$$

$$\therefore \text{ transmission time} = 9932 \text{ ms for 28 object}$$

$$\therefore \text{ transmission time} = 354.7 \text{ ms per object}$$

$$\therefore X = \frac{24 \times 8}{354/1000} = 541.3 \text{ Mbps}$$

3(a)

Half close technique :

When one side finishes 4. transmission, but still can receive data from the other side.

Full close technique:

Both side closes finishes transmission, and connection resources are released.

Half close can ensure orderly transmission, when one side finishes but still can receive from the other side. Full close is used to completely close the connection when both sides finish.

3(b)

If a sender receives three duplicate ACKs, it means that a segment was lost. TCP's fast transmit

treats three duplicate ACKs as a
signal to retransmit missing segment
without waiting for RTO, avoiding delay
& thus allows some time to be saved.

3(c)(i)

$n = 4;$

$seq(4) = 9430 + (4-1) * 889$

$= 12097$

$Ack = seq(4) + 889 = 12097 + 889$

$= 12986$

3(c)(ii)

$m = 11,$

$Seq - req(11) = 8485 + (11-1) * 235$

$= 10835$

$seq(9) = 9430 + (9-1) * 889$

$= 16542$

3(c)(III)

Bytes received upto 13th segment.
$$= 13 \times 889 = 11,557 \text{ bytes}$$

Bytes processed by application
$$= 5 \times 889 = 4,445 \text{ bytes}$$

Unprocessed bytes $= 7,112$

Available window $= 10005 - 7112$
$$= 2893 \text{ bytes}$$
$\uparrow$
Client RWND when
13th segment arrived.