1)

a)

The time values will most likely be different, but the IP values will be the same.

This is because the IP address of the all parties from the user to the target route will remain the same unless they have been purposefully changed, or a dynamic IP address is used but both scenarios would be unlikely to occur in a short window before repeating the command. The time values will change as they represent how long the response from each router took, which can change even slightly due to a difference in the connection between the user’s router and each of the routers passed through on the way to the target domain.

b)

It would support 5 users, as each user would need 1/5th of the 10 mbps link. This can be calculated by dividing the shared link but the speed that each user transmits data at, 10 / 2 = 5 users.

c)

The client will send seven HTTP requests (one for each object) and receive seven HTTP responses. This is because HTTP is a protocol that returns only a single object per request, so the client has to send one request for each object in order to receive the contents of the full web page.

d)

host requests the IP address for [www.sussex.ac.uk](http://www.sussex.ac.uk) from the local DNS server, dns.google.com

local DNS server requests IP address from root DNS server

root DNS server does not have the IP for [www.sussex.ac.uk](http://www.sussex.ac.uk), but redirects the local DNS to a Top Level Domain server as it would be responsible for .ac.uk domains

local DNS server requests IP address from Top Level Domain server

TLD DNS server does not have the IP for [www.sussex.ac.uk](http://www.sussex.ac.uk), but redirects the local DNS to the authoritative DNS server owned by University of Sussex

Local DNS server request IP address for [www.sussex.ac.uk](http://www.sussex.ac.uk) from dns.sussex.ac.uk

Authoritative DNS server for sussex responds with the IP address for [www.sussex.ac.uk](http://www.sussex.ac.uk)

Local DNS server passes the IP address for www.sussex.ac.uk to the host so the host can access the website

e)

The local DNS cache will have a record of a recently accessed website, this can be viewed by any user using a command to search through the local DNS cache. The time since the query will determine how recently the website was accessed in the department. The local DNS would have records for the whole university though, so it would not be able to determine if someone in a specific department, like Informatics, accessed the website.

2)

a)

The requests from A and B pass through the same socket at Host C with a randomly generated port number. This is because the port 6000 is not used by the server to send packets back to the client, it is only used to receive requests from the client. The port used for requests will be randomly generated by the client upon creation, so that multiple requests can be sent to Host C with Host C being able to differentiate between the requests. Only one socket is used by the server to receive request however, so A and B will both pass through the same socket but with randomly generated port numbers.

b)

Seq. no: 10200, source port: 45000, destination port: 80. I think this because the sequence number cannot be below 10000, as the first segment has seq num 10000 and for the second segment to be in sequence it must have a number larger than 10000. The source port must be 45000 as it is being sent from the same place as the first segment, and the destination port must be the same as the port for Host B will still be 80 as it was in the first segment. As the 200-byte segment has already been sent to Host B, I would assume that the second segment must start with sequence number 10200 as it would be the current sequence number after the first segment’s 200 bytes are sent (10000 + 200).

c)

Ack. no: 10200, source port: 80, destination port: 45000. I think this because the sequence number would be unchanged by the order at which the segment arrive to Host B, as the sequence number is determined by Host A when a segment packet is created. It would send an acknowledgement number of 10200 because the acknowledgment number will be the same as the sequence number, in order for Host A to affirm that the segment has been properly received by Host B. The source port would be 80 as the acknowledgment packet would be sent from Host B which has port 80, and the destination port would be 45000 as the port for Host A is 45000 which is where the ack packet is heading to.

d)

i)

1 RTT, 2 RTT, 3 RTT, 4 RTT, 5 RTT

ii)

9 RTT, 10 RTT, 11 RTT, 12 RTT, 13 RTT, 14 RTT, 15 RTT, 16 RTT, 17 RTT, 18 RTT, 19 RTT

iii)

A loss event occurred, which was triggered by a timeout and set the cwnd to 1.

iv)

The cwnd reached half of the value of what the cwnd was the previous timeout, which was 16 cwnd so the congestion avoidance phase starts at 8 cwnd.

v)

8 cwnd (half of 16 which is what it was at when a loss event occurred).

vi)

9 cwnd (half of 18 which is what the cwnd was at when the loss event occurred at 19 RTT).