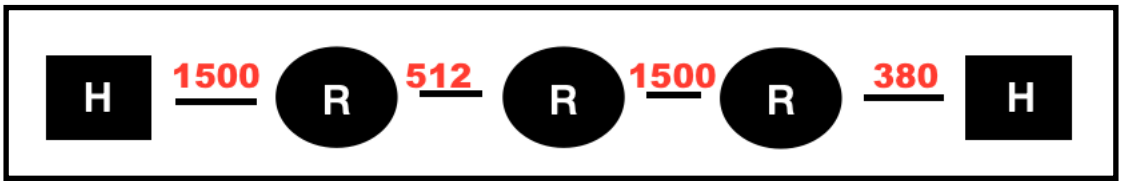
Quiz 2

1. **(1 M)** How many RTTs does it take for TCP slow start to open the window to 2MByte? Assume that the packet size is 1KByte? Format X (e.g. 4)
2. **(1 M)** Host A has established a TCP connection to Host B and as part of the connection it sends two TCP segments back to back. The first segment has sequence number 40; the second has sequence number 120.
   a. How much data/payload is in the first segment?
   b. Suppose that the first segment is lost but the second segment arrives. In the acknowledgement that Host B sends to Host A, what will be the acknowledgment number?
3. **(1 M)** An organization has been assigned the network prefix 120.21.0.0/16 and it needs to create a set of subnets that support up to 25 hosts on each subnet. What is the maximum possible number of such subnets in the given network?
4. **(2 M)** Normally routing protocols do not consider Quality of Service (QoS) which is needed to support real-time video/voice flows. The idea here is to modify DV so that the capacity of each link of the discovered route is higher than a minimum threshold. And if there is more than one route that satisfies the requirement, we choose the one that offers maximum bottleneck capacity.
   A few examples assuming our minimum threshold is 100kbps:
   • If there are three hops along a route from A to D with link capacities (500, 80, 20) kbps respectively, then this route cannot be selected since links with 80 and 20kbps capacity do not satisfy our minimum requirement of 100kbps.
   • If link capacities along a route from X to Z made up of 3 hops are (500, 800, 200) kbps, then this route can potentially be selected. If there is yet another route from X to Z made of 4 hops with capacities (600, 300, 800, 500), this second route is selected since the bottleneck capacity of 300 kbps is more than the first route's bottleneck capacity of 200 kbps.
   This logic has to be implemented in a distributed fashion using the DV framework. So, how would you modify the DV protocol to implement this feature? Specify clearly
   a. What will a node advertise ?
   b. What does a node do on receipt of an advertisement from a neighbour?
   Explain it in clear steps using mathematical expressions where required.
5. Consider the topology below where 3 routers interconnect the two hosts H1 and H2. The numbers in the figure indicate the MTU size on the given link. H1 is to the left (before 1500) and H2 is to the right (after 380) in the figure. Suppose a TCP message of 1460 bytes of data/payload and 20 bytes of TCP header is passed to the IP layer at H1 to be forwarded to H2.



   a. **(1 M)** How many fragments will H2 receive? Format X (e.g. 3)
   b. **(1 M)** For the first fragment received at H2, what is the M bit flag value (More fragments to follow), Offset field and IP payload size in bytes in the IP header? Format M O P (e.g. 1 24 360)
   c. **(1 M)** For the 4th fragment received at H2, what is the M bit flag value (More fragments to follow), Offset field and IP payload size in bytes in the IP header? Format M O P (e.g. 1 24 360)

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d. **(1 M)** For the last fragment received at H2, what is the M bit flag value (More fragments to follow), Offset field and IP payload size in bytes in the IP header? Format M O P (e.g. 1 24 360)