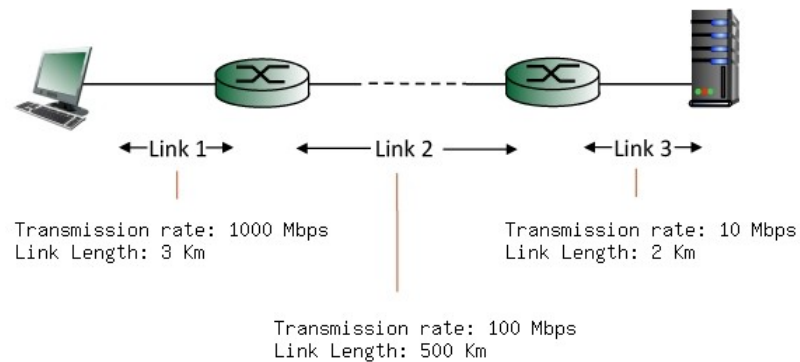1. Consider the figure below, with three links, each with the specified transmission rate and link length.

Find the end-to-end delay (including the transmission delays and propagation delays on each of the three links, but ignoring queueing delays and processing delays) from when the left host begins transmitting the first bit of a packet to the time when the last bit of that packet is received at the server at the right. The speed of light propagation delay on each link is 3x10**8 m/sec. Note that the transmission rates are in Mbps and the link distances are in Km. Assume a packet length of **16000** bits. Give your answer in milliseconds.   [10+10+10=30 Marks]

2. Consider the figure below, in which a single router is transmitting packets, each of length L bits, over a single link with transmission rate R Mbps to another router at the other end of the link.

L: packet length (in bits)
R: link transmission rates (Mbits/sec)

Queue of
packets waiting
for output link
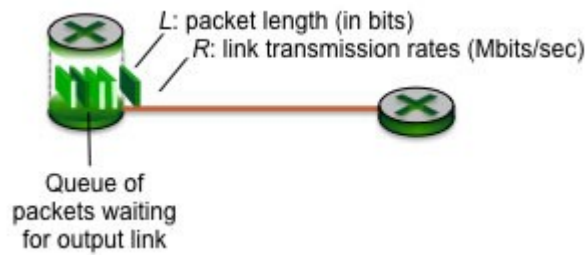
Suppose that the packet length is L= 12000 bits, and that the link transmission rate along the link to router on the right is R = 100 Mbps.

(a) What is the transmission delay (the time needed to transmit all of a packet's bits into the link)?
(b) what is the maximum number of packets per second that can be transmitted by the link?

[10+10=20 Marks]