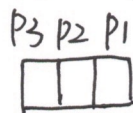


T6. (a)



A — R1 — R2 — B

$$P1 \text{ arrives } R1 = 5ms + 10ms = 15ms$$

$$P1 \text{ leaves } R1 = 15 + 50 = 65ms$$

$$P1 \text{ arrives } R2 = 65 + 90 = 155ms$$

$$P1 \text{ leaves } R2 = 155 + 5 = 160ms$$

$$P1 \text{ arrives } B = 160 + 10 = 170ms$$

At 170ms, the first packet P1 arrives B.

$$(b) \quad P2 \text{ arrives } R1 = 5 + 5 + 10 = 20ms$$

$$P2 \text{ in queue} = 65 - 20 = 45ms$$

$$P2 \text{ leaves } R1 = 65 + 50 = 115ms$$

$$P2 \text{ arrives } R2 = 115 + 90 = 205ms$$

$$\therefore 205ms > 160ms$$

\therefore now P1 was already left R2

$$\Rightarrow P2 \text{ leaves } R2 = 205 + 5 = 210ms$$

$$P2 \text{ arrives } B = 210 + 10 = 220ms$$

$$P3 \text{ arrives } R1 = 5 + 5 + 5 + 10 = 25ms$$

$$P3 \text{ in queue} = 115 - 25 = 90ms$$

$$P3 \text{ leaves } R1 = 115 + 50 = 165ms$$

$$P3 \text{ arrives } R2 = 165 + 90 = 255ms$$

$$As \quad 255ms > 210ms$$

$$\Rightarrow P3 \text{ leaves } R2 = 255 + 5 = 260ms$$

$$P3 \text{ arrives } B = 260 + 10 = 270ms$$

The 3-rd packet arrive to B at 270ms
for each packet, total queueing delay: $P1 = 0, P2 = 45ms, P3 = 90ms$
total queueing delay = $45ms + 90ms = 135ms$

$$\Rightarrow \text{average queueing delay (out of 3 packets)} = \frac{135}{3} ms$$

$$(c) \quad \left. \begin{array}{l} P2 \text{ queueing: } 65 - (20 + 5) = 0 \\ P3 \text{ queueing: } 115 - (25 + 25) = 0 \end{array} \right\} \Rightarrow S = 45ms$$

When the minimum $S = 45ms$, none of the packets will suffer any queueing delay in the middle.

YES. I think sender A can find a suitable spacing in reality to prevent queueing delay in the middle.