

作业 1

5.

(a) 每个收费站之间相距 $150/2=75(\text{km})$

每个收费站的传输时延 $=10 \times 12 = 120(\text{s})=2\text{min}$

收费站之间的传播时延 $=75/100=0.75(\text{h})=45\text{min}$

所以，车队通过三个收费站所需时间 $t=2 \times 3 + 45 \times 2 = 6 + 90 = 96(\text{min})$

(b) 传播时延同(a),

传输时延 $=8 \times 12 = 96(\text{s})=1.6\text{min}$

所以，总时长 $t=1.6 \times 3 + 45 \times 2 = 94.8(\text{min})$

8.

$$a. \frac{3\text{Mbps}}{150\text{kbps}} = 20$$

\therefore 最多支持20位用户

$$b. 10\%$$

$$c. p = 0.1$$

$$P = C_{120}^n p^n (1-p)^{120-n}$$

$$= C_{120}^n (0.1)^n 0.9^{120-n}$$

d.

同时有21或大于21位用户正在传输的概率:

$$\begin{aligned}P &= 1 - P\left(\sum_{i=1}^{120} X_i < 21\right) \\&= 1 - P\left(\frac{\sum_{i=1}^{120} X_i - 12}{\sqrt{120 \times 0.1 \times 0.9}} \leq \frac{21 - 12}{\sqrt{120 \times 0.1 \times 0.9}}\right) \\&= 1 - P\left(\frac{\sum_{i=1}^{120} X_i - 12}{3.286} \leq \frac{9}{3.286}\right) \\&= P(Z \leq 2.74) \\&= 1 - 0.997 = 0.003\end{aligned}$$

∴ 实际有多于或等于21位用户在传输的概率为0.3%。

10.

$$\begin{aligned}10. \quad d_{\text{总}} &= d_{\text{proc}} \times 2 + \left(\frac{L}{R_1} + \frac{L}{R_2} + \frac{L}{R_3}\right) \\&\quad + \left(\frac{d_1}{S_1} + \frac{d_2}{S_2} + \frac{d_3}{S_3}\right)\end{aligned}$$

当 $L = 1500 \text{ byte} = 12000 \text{ bit}$.

$$\begin{aligned}d_{\text{总}} &= 3 \text{ ms} \times 2 + \left(\frac{12000}{2000} \times 3\right) \text{ ms} \\&\quad + \left(\frac{5000 \times 10^3}{2.5 \times 10^8} + \frac{4000 \times 10^3}{2.5 \times 10^8} \right. \\&\quad \left. + \frac{1000 \times 10^3}{2.5 \times 10^8}\right) \times 10^3 \text{ ms}\end{aligned}$$

$$\begin{aligned}&= 6 + 6 \times 3 + (20 + 16 + 4) \\&= 64 \text{ (ms)}\end{aligned}$$