無線通訊網路作業二

系級：__________ 組別：__________ 學號：__________ 姓名：__________

1. The following table shows the density of the random variable X.

x	1	2	3	4	5	6	7	8
p(x)	0.03	0.01	0.04	0.3	0.3	0.1	0.07	?

a. Find $p(8)$.

$$P(8) = 1-0.03-0.01-0.04-0.3-0.3-0.1-0.07$$

$$= 0.15$$

b. Find the table for F CDF.

x	1	2	3	4	5	6	7	8
F(x)	0.03	0.04	0.08	0.38	0.68	0.78	0.85	1

c. Find $P(3 \le X \le 5)$.

$$P(3 \le x \le 5) = P(3) + P(4) + P(5) = 0.64$$

d. Find $P(X \le 4)$ and $P(X < 4)$. Are the probabilities the same?

$$\left.\begin{aligned} P(x \le 4) &= F(4) = 0.38 \\ P(x < 4) &= F(3) = 0.08 \end{aligned}\right\} \text{Not equal}$$

e. Find $F(-3)$ and $F(10)$.

$$F(-3) = 0$$

$$F(10) = 1$$

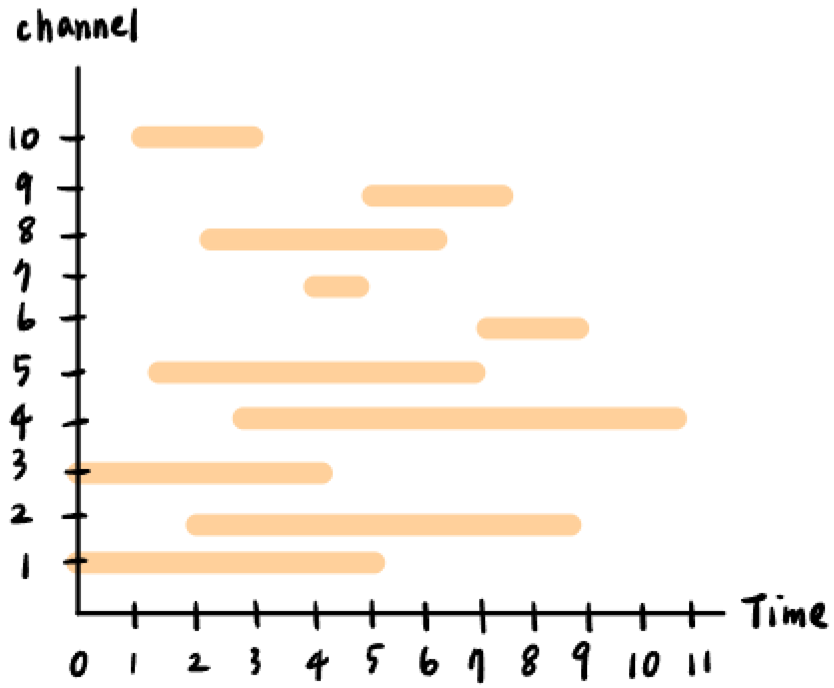
2. A snapshot of the traffic pattern in a cell with 10 users of a wireless system is given as follows:

User Number	1	2	3	4	5	6	7	8	9	10
Call Initiation Time	0	2	0	3	1	7	4	2	5	1
Call Holding Time	5	7	4	8	6	2	1	4	3	2

a. Assuming the call setup/connection and call disconnection time to be zero, what is the average duration of a call?

$$\frac{5+7+4+8+6+2+1+4+3+2}{10} = 4.2$$

b. What is the minimum number of channels required to support this sequence of calls?



the minimum number required is 6

c. Show the allocation of channels to different users for part b. of this problem.

只要能在6個 channel 內正確排序

皆算正確

d. Given the number of channels obtained in part b., for what fraction of time are the channels utilized?

Total amount of time channels are available is 66

Total duration of call is 42

$\therefore$ fraction of time channels are used : $\frac{42}{66}$

3. Consider a cellular system in which each cell has only one channel (single server) and an infinite buffer for storing the calls. In this cellular system, call arrival rates are discouraged – that is, the call rate is only $\lambda/(n+1)$ when there are n calls in the system. The interarrival times of calls are exponentially distributed. The call-holding times are exponentially distributed with mean rate μ. Develop expressions for the following:

Traffic intensity $\rho = \dfrac{\frac{\lambda}{n+1}}{\mu} = \dfrac{\lambda}{(n+1)\mu}$

$$\left(\frac{\lambda}{i+1}\right) P_i = \mu P(i+1) \quad , \quad 0 \le i \le \infty$$

$$P_i = \frac{1}{i!}\left(\frac{\lambda}{\mu}\right)^i P_0 \quad , \quad 0 \le i \le \infty$$

$$\sum_{i=0}^{\infty} P_i = 1$$

$$\Rightarrow \quad P_0 = \left[\sum_{i=0}^{\infty} \frac{1}{i!}\left(\frac{\lambda}{\mu}\right)^i\right]^{-1} = e^{-\frac{\lambda}{\mu}}$$

a. Steady-state probability p_n of n calls in the system.

$$P_n = \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n e^{-\frac{\lambda}{\mu}} \quad , \quad 0 \le n \le \infty$$

b. Steady-state probability p_0 of no calls in the system.

$$P_0 = e^{-\frac{\lambda}{\mu}}$$

c. Average number of calls in the system, L_s.

$$L_s = \sum_{i=0}^{\infty} i P_i = \frac{\lambda}{\mu}$$