

網通原理作業報告：黃右萱(0416323)

Question1.

Argument:

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1.

consider poisson distribution with arrival rate $\lambda_0 = 0.5$ (per min), let $\Delta T = 1$ (min)

the probability distribution function: $P(X_k = k) = \frac{e^{-\lambda} \cdot \lambda^k}{k!}$, where

X_k represent the r.v. that there're X_k arrivals within ΔT times

consider r.v. T being the time interval of two consecutive arrivals (min)

we have that $P(T \leq t) = 1 - P(T > t) = 1 - P(X_{\lambda_1} = 0)$, where $\lambda_1 = \frac{t \lambda_0}{\Delta T}$

thus $P(T \leq t) = 1 - e^{-\lambda_1} = 1 - e^{-\frac{t \lambda_0}{\Delta T}}$

we know that the pdf for T , $f_T(t) = \frac{dP(T \leq t)}{dt} = \frac{\lambda_0}{\Delta T} \cdot e^{-\frac{t \lambda_0}{\Delta T}}$, from

which we know that the inter-arrival time T satisfies exponential distribution

For simulation, since $P(T \leq t) = 1 - e^{-\frac{t \lambda_0}{\Delta T}}$; we have

$-\ln(1 - P(T \leq t)) \cdot \frac{\Delta T}{\lambda_0} = t$, therefore consider u as a

uniformly distributed r.v. range in $[0, 1]$,

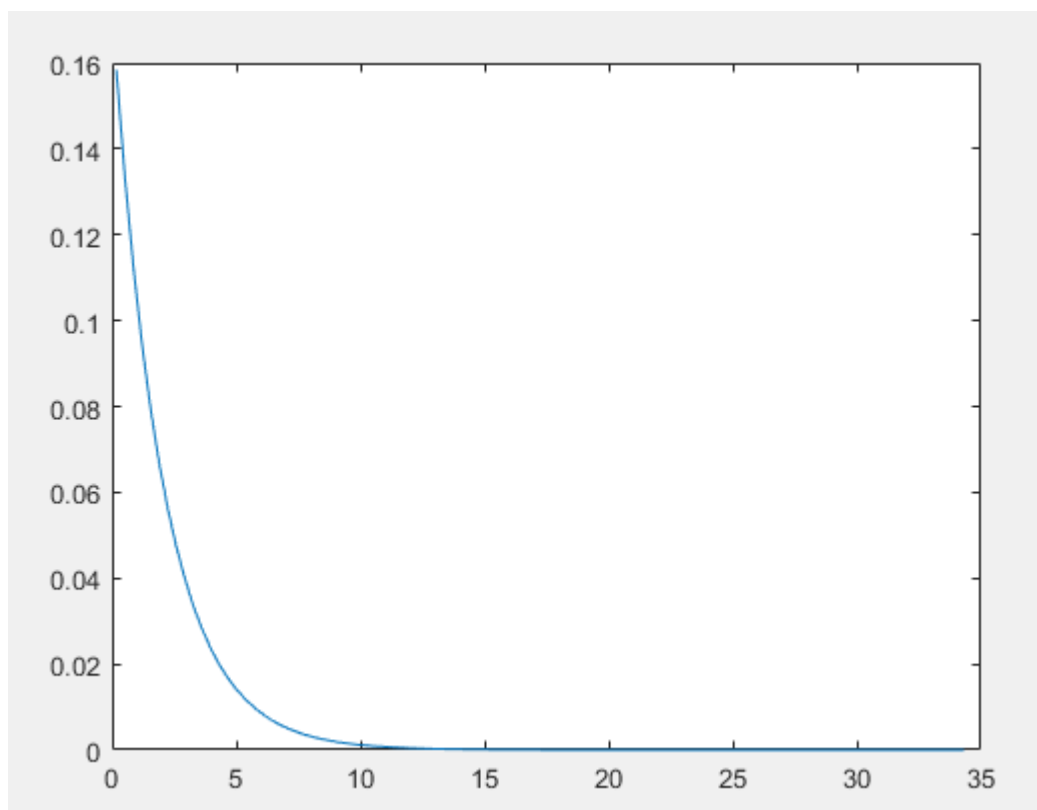
$T_1 = -\ln(1 - u) \cdot \frac{\Delta T}{\lambda_0}$ have the same distribution function as T does.

we use such way to construct a channel request generator.

作法：

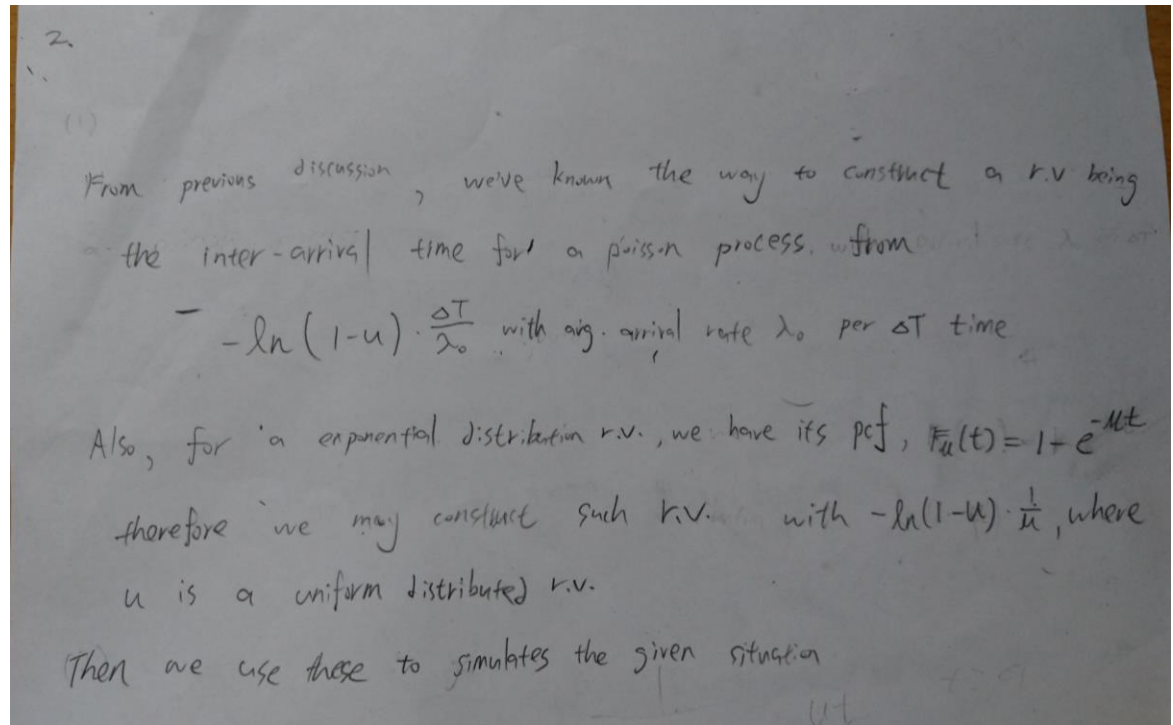
利用圖中公式，每次取一亂數轉換為 poisson process 之間隔時間，然後統計其分布狀況並繪出。

Result:



Question2.

Argument:



作法(2-1):

不借通道，先取亂數把每個 BS 的 request 時間 push 到 queue 裏頭，每次將 queue front 抽取出來順便更新 BS 狀態然後(如果沒有被 block)亂數決定結束時間。

Result 2-1:

```
Block rate:
BS1:0.354701
BS2:0.291525
BS3:0.253369
BS4:0.378151
BS5:0.321429
BS6:0.226766
BS7:0.247312
BS8:0.257143
BS9:0.2891
BS10:0.238095
BS11:0.343511
BS12:0.207317
Avg Block Rate: 0.284035
```

作法(2-2)：

類似上題，但把每個 BS 的 request time 和 BS index 包在一起 push 進有序查詢結構(這裡是 set)，每次抽取出最先發生的 request，更新 BS 狀態，包含歸還與重置通道，然後再去找通道，找到通道後利用公式亂數決定結束時間。

找通道時先找 request 所屬 BS 的通道，找不到再找鄰居的通道，從有最多剩餘通道的 BS 開始找，如果都找不到那就會 block，一個通道可以被採用的條件是鄰近 BS 相同的通道沒有被採用。

Result 2-2:

```
Total: 2937
No borrow: 1702
Borrow: 621
Block: 614
Avg block rate: 0.209057
  BS1: 0.1
  BS2: 0.102389
  BS3: 0.401028
  BS4: 0.353535
  BS5: 0.294416
  BS6: 0.0322581
  BS7: 0.12
  BS8: 0.40566
  BS9: 0.242857
  BS10: 0.403509
  BS11: 0.097561
  BS12: 0.153061
```