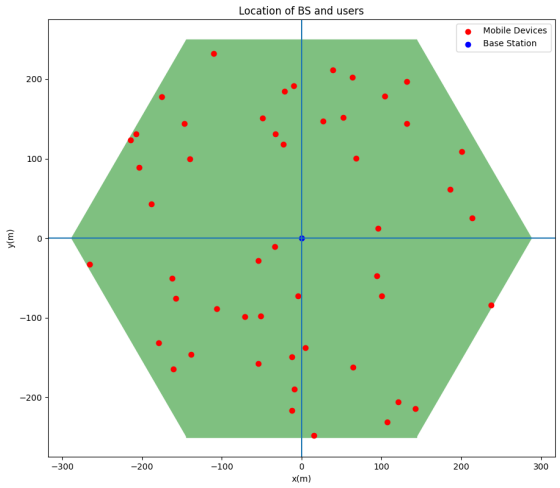
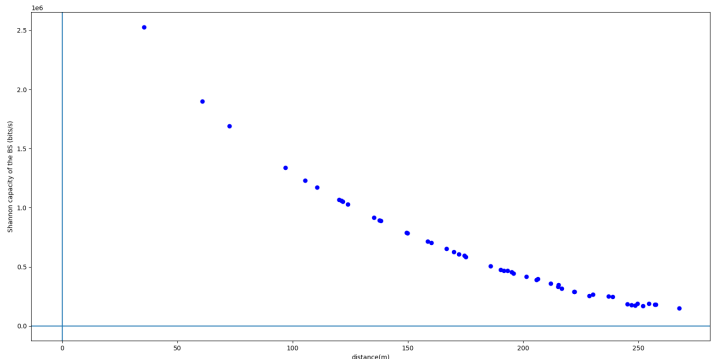
1.



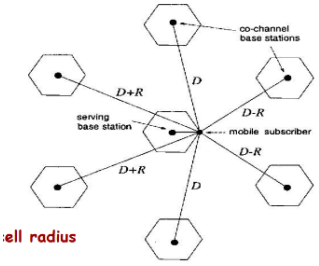
2.



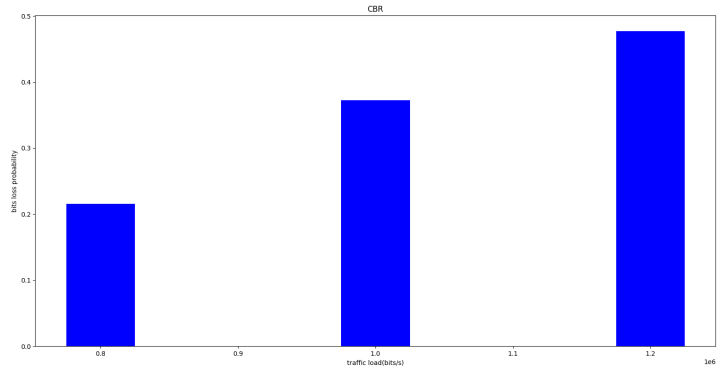
以下是我算Shannon_capacity的程式碼

```
surroundings = [4, 5, 8, 10, 13, 14]
interference = 0

# The interference from the nearest 6 BS dominates so I ignore the remaining BS.
for k in surroundings:
    interference += (h_base * h_mobile)**2 / m.dist([center_BS_x[k], center_BS_y[k]], [
        x[i], y[i]])**4 * 10**((gainRx + gainTx + powerTx) / 10)

signal = (h_base * h_mobile)**2 / \
    distance_BS_MS[i]**4 * 10**((gainRx + gainTx + powerTx) / 10)
Shannon_capacity.append(bandwidth_MS * m.log2(1 + signal / interference))
```

根據上課所述，當interference和thermal noise並存時，通常是interference dominates。而我也用數學算了一次，周圍6個BS對MS的interference差不多在10^{-5}
的數量級，而thermal noise差不多會是10^{-15}的數量級，所以我選擇忽略thermal noise。另外上課也提到，BS對MS的干擾，通常是只考慮周圍6個BS就好，其它因為相較之下距離太遠，可以忽略。



3.



關於{X_l, X_m, X_h}
我使用

```
CBR = [40 / 50 * 10**6, 50 / 50 * 10**6, 60 / 50 * 10**6]
```

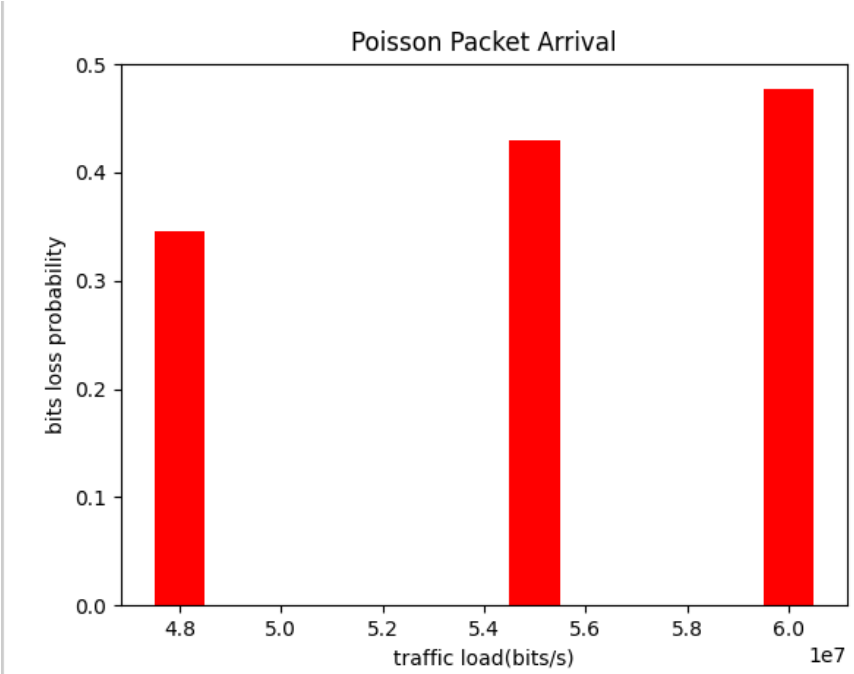
原因是我測了10次50個Shannon_capacity的和，結果如下圖

```
40039678.36572355
nanasawa@LAPTOP-KS
/mnt/c/Users/11211
b09901154_hw4$  na
APnanananananananana
nanasawa@LAPTOP-KS
nanasawa@LAPTOP-KS
nanasawa@LAPTOP-KS
nanasawa@LAPTOP-KS
34382042.18028715
nanasawa@LAPTOP-KS
37889565.02269606
nanasawa@LAPTOP-KS
36673474.2435731
nanasawa@LAPTOP-KS
30769497.0076955
nanasawa@LAPTOP-KS
30734874.18032705
nanasawa@LAPTOP-KS
32477393.665415265
nanasawa@LAPTOP-KS
34839694.78052124
nanasawa@LAPTOP-KS
35861676.52754006
nanasawa@LAPTOP-KS
36162698.0578012
```

avg = 34.4 M，所以我選擇比avg大一點的CBR。

Bonus
1. 2.
我一二題用和上一題一樣的程式碼

3.



{λ_l, λ_m, λ_h}我使用

```
Lambda = [48 * 10**6, 55 * 10**6, 60 * 10**6]
```

我上網查Poisson distribution的lambda就是這個分布的期望值, 所以我以此當作我選擇lambda的參考。