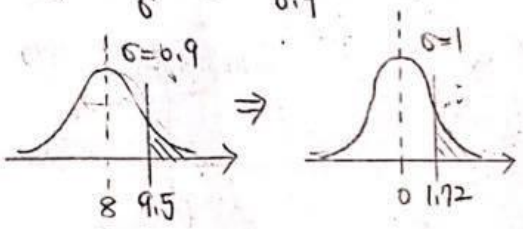
HandWrite

6.20

(a) $\mu = 8$ kg. $\sigma = 0.9$

$$z_a = \frac{x-\mu}{\sigma} = \frac{9.55-8}{0.9} = 1.72$$



$$P(z > 1.72) = 1 - P(z < 1.72)$$

$$= 1 - 0.9573 = 0.0427$$

(b) $z_b = \frac{x-\mu}{\sigma} = \frac{8.65-8}{0.9} = 0.72$

$$P(z \leq z_b) = P(z \leq 0.72) = 0.7642$$

(c) $z_{c1} = \frac{7.25-8}{0.9} = -0.83$

$z_{c2} = \frac{9.15-8}{0.9} = 1.28$

$$P(-0.83 < z < 1.28) = 0.8997 - 0.2033$$

$$= 0.6964$$

6.28

$p = 72\%$ $n = 100$ $np = 72 > 5$ $n(1-p) = 28 > 5$

we can approximate this binomial with normal distribution $\mu = 100 \cdot 0.72 = 72$ $\sigma^2 = 100 \cdot 0.72 \cdot 0.28 = 20.16$

(a) $P(X \geq 80)$

$$= 1 - \sum_{k=0}^{79} b(k; 100, 0.72) \approx 1 - P\left(z \leq \frac{(80-0.5)-72}{\sqrt{20.16}}\right)$$

$$= 1 - P(z \leq 1.670) = 1 - 0.9525 = 0.0475$$

(b) $P(X \leq 68)$

$$= 1 - \sum_{k=0}^{68} b(k; 100, 0.72) \approx 1 - P\left(z \leq \frac{(68+0.5)-72}{\sqrt{20.16}}\right)$$

$$= P(z \leq -0.78) = 0.2177$$

6.58

$\lambda = 5$ $\beta = \frac{1}{\lambda} = \frac{1}{5}$ $\alpha = 10$ center = 2 min

X = time in minutes that occurs before 10 automobiles.

(a) $\lambda = 5$ $\beta = \frac{1}{\lambda} = \frac{1}{5}$ $\alpha = 10$

$P(X > 10) = 1 - P(X \leq 10) = 1 - 0.9863$

$= 0.0137$

(b)

$$f(x) = \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}$$

$P(X > 2) = 1 - P(X \leq 2)$

$$P(X \leq 2) = \int_0^2 \frac{1}{\beta^\alpha} \frac{x^{\alpha-1} e^{-x/\beta}}{\Gamma(\alpha)} dx \quad \text{let } y = \frac{x}{\beta}$$

$dy = \frac{1}{\beta} dx$

6.58

$$P(x \le 2) = P(Y \le 10)$$

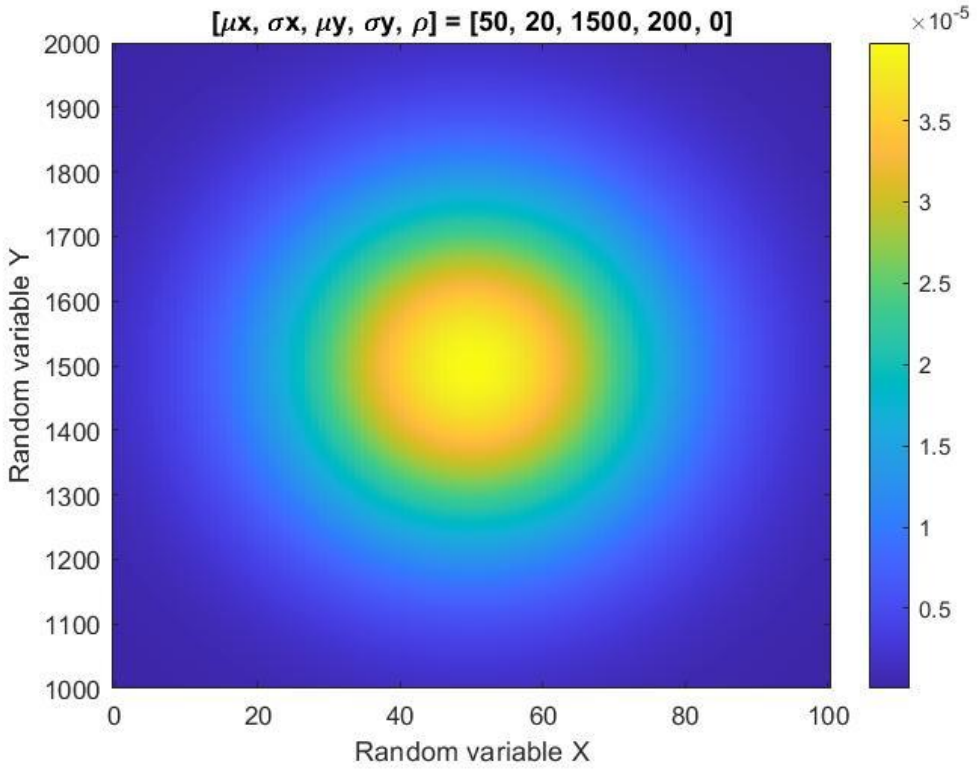
$$= \int_0^{10} \frac{y^{\alpha-1} e^{-y}}{\Gamma(\alpha)} dy = \int_0^{10} \frac{y^{10-1} e^{-y}}{\Gamma(10)}$$

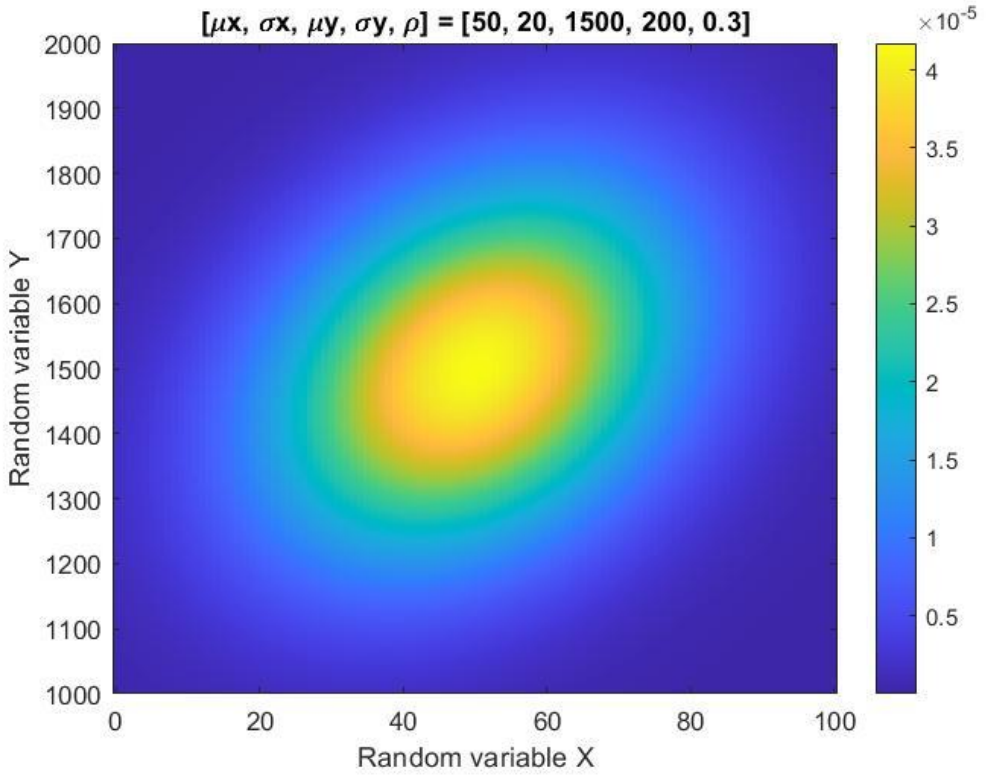
$$= 0.542$$

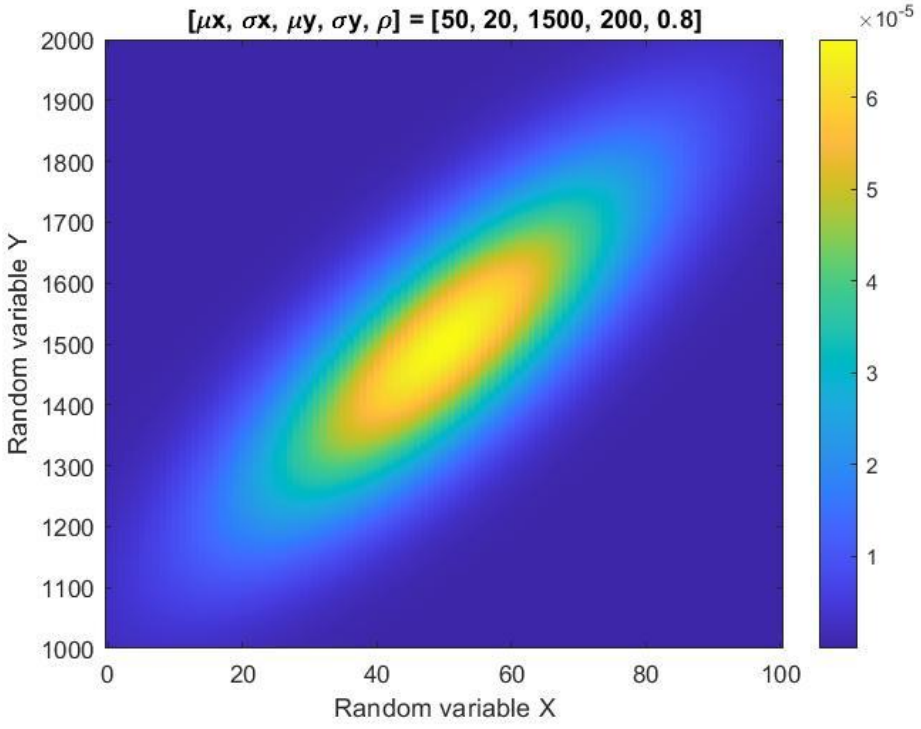
$$P(X > 2) = 1 - P(X \le 2) = 1 - 0.542 = 0.458$$

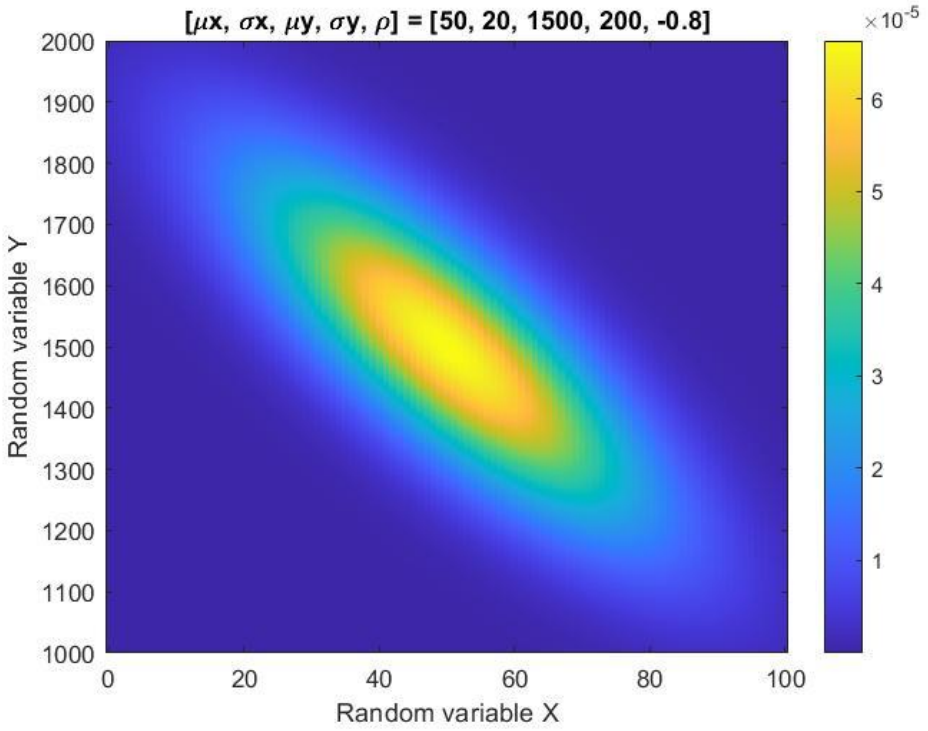
Matlab

1(a)




[μx, σx, μy, σy, ρ] = [50, 20, 1500, 200, 0.3]
×10^-5
4
3.5
3
2.5
2
1.5
1
0.5
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
Random variable Y
0
20
40
60
80
100
Random variable X


[μx, σx, μy, σy, ρ] = [50, 20, 1500, 200, 0.8]
×10^-5
6
5
4
3
2
1
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
Random variable Y
0
20
40
60
80
100
Random variable X



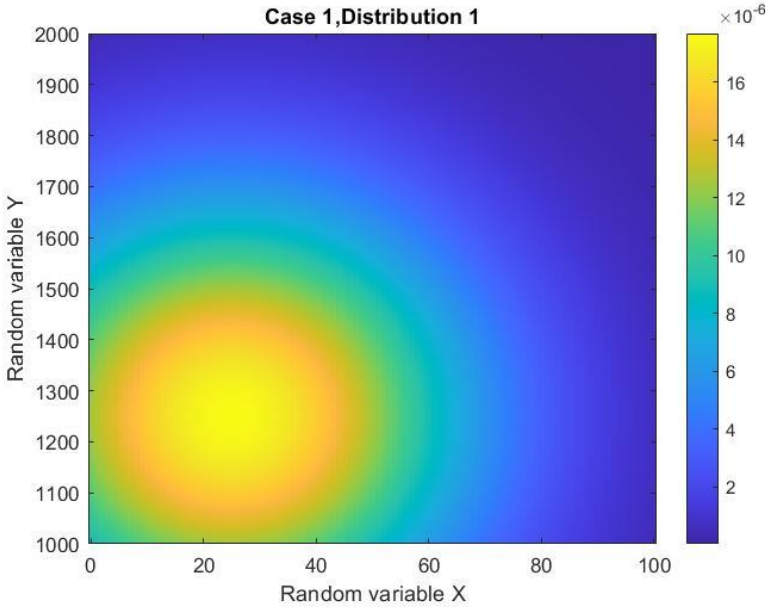
1(b)

當ρ=0 時，x,y 向同心圓一樣從(μx, μy)放射出去，當ρ越來越大時，x,y 會越來越扁且往對角方向斜，但分佈中心仍然是(μx, μy)；而當ρ為正值時，斜線方向是(0,1000)-(100,2000)的方向，ρ為負值時則是(0,2000)-(100,1000)的方向；而且由第三和第四組可以發現，相同ρ的傾斜程度是一致的，指示方向相反而已。

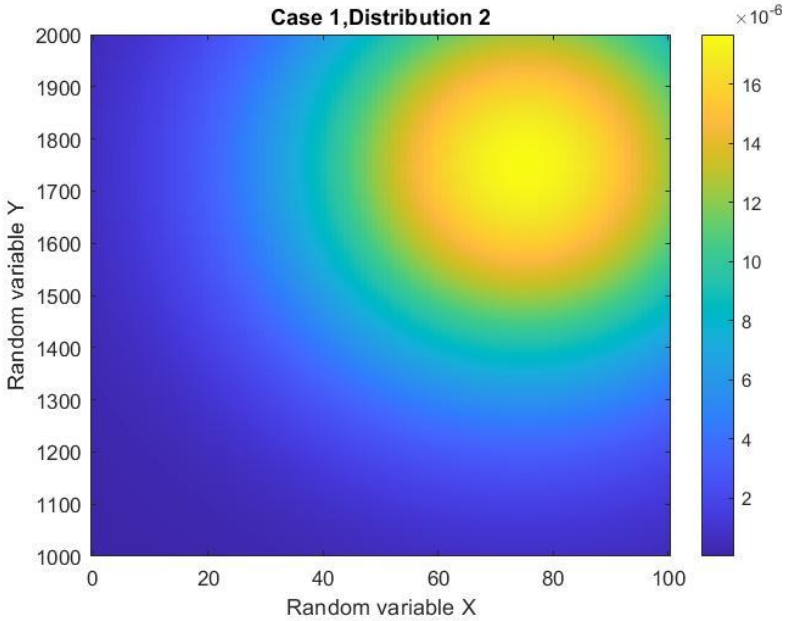
2(a)

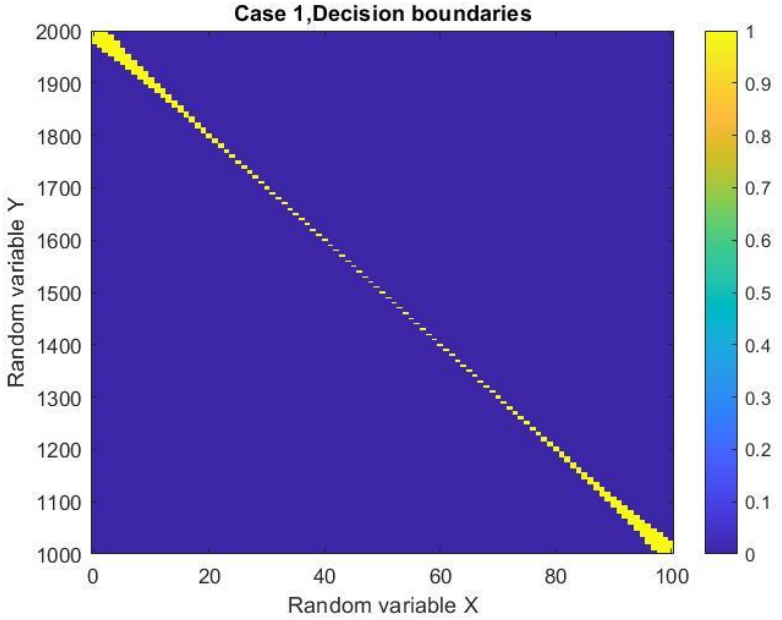
Case1

Distribution 1: [μx, σx, μy, σy, ρ] = [25, 30, 1250, 300, 0]



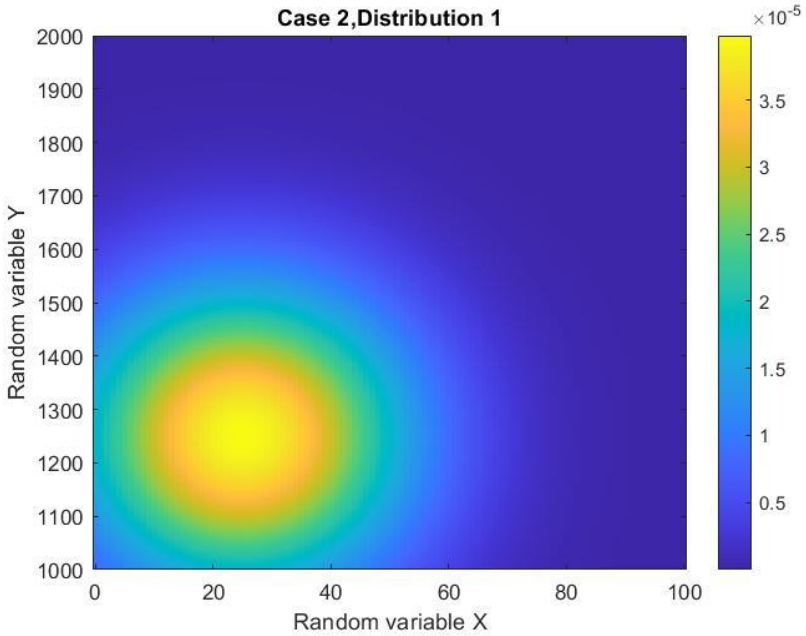
Distribution 2: [μx, σx, μy, σy, ρ] = [75, 30, 1750, 300, 0]



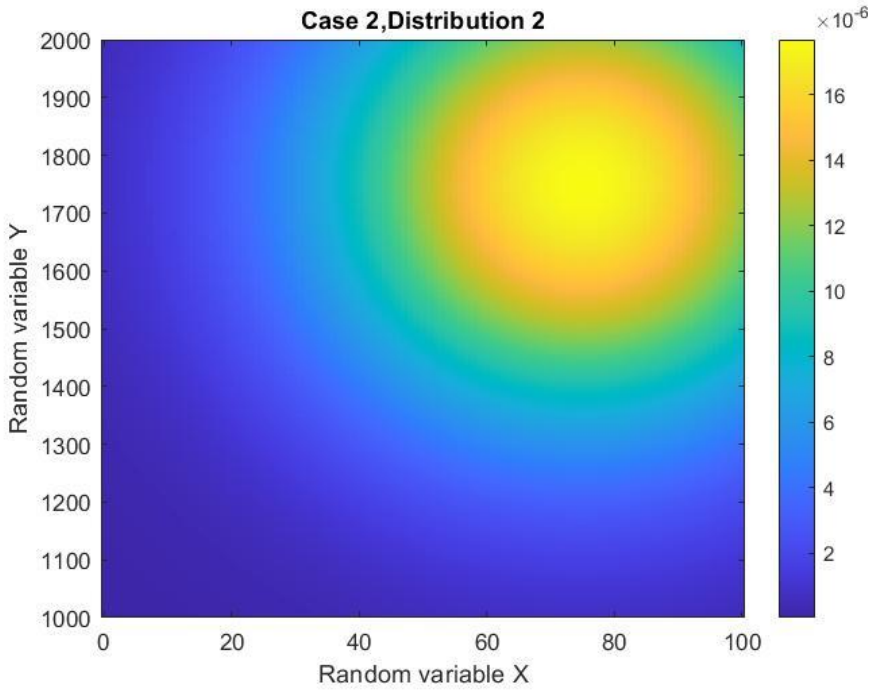


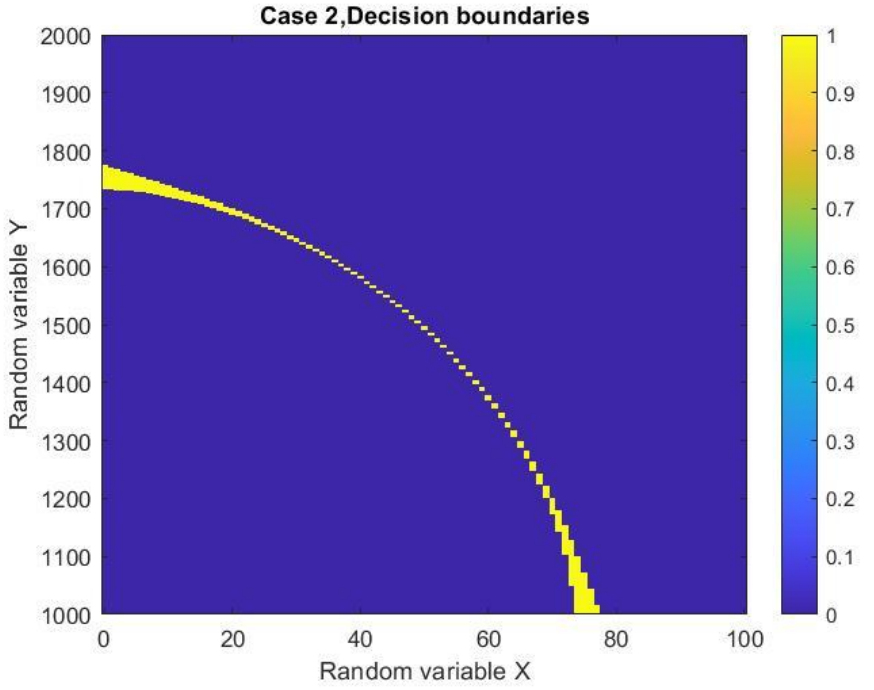
Case2

Distribution 1: [μx, σx, μy, σy, ρ] = [25, 20, 1250, 200, 0]



Distribution 2: [μ_x, σ_x, μ_y, σ_y, ρ] = [75, 30, 1750, 300, 0]





2(b)

兩張圖的分佈都是一個在右上一個在左下，第一個是 x 和 y 的 standard deviation 分別相同，所以兩者的擴散程度是差不多的，此外，兩者橘色部分距離中心點也差不多，所以 decision boundary 看起來會很接近斜直線而且篇

在正中間；第二個的話 Distribution 2 的 standard deviation 比較大，也因此比較小的值會在左下角，而兩者交界處也偏向左下角。