R05631027 楊皓文　　ML H.W. #1

1 (a) $K = \pi$

mean : undefined

variance : undefined

(b) height $h = \dfrac{1}{a-(-a)} = \dfrac{1}{2a}$

mean : $\dfrac{1}{2}[(-a)+a] = 0$

variance : $m_1 = \dfrac{a+b}{2}$, $m_2 = \dfrac{a^2+ab+b^2}{3}$ $(-a)$

$\Rightarrow m_2 - m_1^2 = \dfrac{a^2+ab+b^2}{3} - \left(\dfrac{a+b}{2}\right)^2 = \dfrac{(b-a)^2}{12} = \dfrac{a^2}{3}$

probability(c~d) : $\dfrac{d-c}{2a}$

(c) probability of score 7 : $\dfrac{6}{36} = \dfrac{1}{6}$

mean : $\mu = \sum x \cdot P(x)$

$= 2\cdot\frac{1}{36} + 3\cdot\frac{2}{36} + 4\cdot\frac{3}{36} + 5\cdot\frac{4}{36} + 6\cdot\frac{5}{36} + 7\cdot\frac{6}{36} + 8\cdot\frac{5}{36}$

$+ 9\cdot\frac{4}{36} + 10\cdot\frac{3}{36} + 11\cdot\frac{2}{36} + 12\cdot\frac{1}{36} = 7$

variance : $Var = \sum (x-\mu)^2 \cdot P(x)$

$= \dfrac{35}{6}$ ※

2. (a) mean : 0.00127

variance : 0.81619

(b) standard deviation : 0.90343

95% confidence intervals :

$\mu \pm 1.96 \dfrac{\sigma}{\sqrt{N}} = [-0.559, 0.561]$

99% confidence intervals :

$\mu \pm 2.576 \dfrac{\sigma}{\sqrt{N}} = [-0.735, 0.737]$

(c) 大約 0% confident ※

3. (a) $\dfrac{\partial f}{\partial x} = 6x - y - 11$

$\dfrac{\partial f}{\partial y} = 2y - x$

(b) $\begin{cases} 6x - y - 11 = 0 \\ 2y - x = 0 \end{cases} \Rightarrow (2,1)$

(c) $\dfrac{\partial^2 f}{\partial x^2} = 6$, $\dfrac{\partial^2 f}{\partial x \partial y} = -1$

$\dfrac{\partial^2 f}{\partial y^2} = 2$, $\dfrac{\partial^2 f}{\partial y \partial x} = -1$

$H(2,1) = \begin{vmatrix} f_{xx} & f_{xy} \\ f_{yx} & f_{yy} \end{vmatrix} = \begin{vmatrix} 6 & -1 \\ -1 & 2 \end{vmatrix} = 11 > 0$ 有極值

$\dfrac{\partial^2 f}{\partial x^2} = 6 > 0 \Rightarrow$ 有極小值 ※

4. L_0 norm :

$\|X\|_0 = 5$

L_1 norm :

$\|X\|_1 = |3| + |-1| + |3| + |5| + |0| + |2| = 14$

L_2 norm :

$\|X\|_2 = \sqrt{3^2 + (-1)^2 + 3^2 + 5^2 + 0^2 + 2^2} = 4\sqrt{3}$

L_∞ norm :

$\|X\|_\infty = 5$ ※

5 (a) McDonald's:

$\mu = 43.3$, $\sigma^2 = 59.34444$, $\sigma = 7.70353$

90% confidence interval : [39.293 47.307]

Burger King:

$\mu = 49$, $\sigma^2 = 27.5$, $\sigma = 5.24404$

90% confidence interval : [45.142 52.858]

(b) $\alpha = 0.01$:

經計算後, $P > \alpha$ ∴ the mean of the 2 populations are the same

$\alpha = 0.05$:

經計算後, $P > \alpha$ ∴ the mean of the 2 populations are the same