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Ans)

1-1

1) 공정한 주사위 $X = \{1, 2, 3, 4, 5, 6\}$ $P(X) = \frac{1}{6}$

$$H(X) = \sum_{x \in X} P(x) \log_2 \left(\frac{1}{P(x)} \right) \\ = \log_2 6$$

2) 모든 6면 주사위 $X = \{6\}$
 $= 0$

3) 주사위 $X = \{1, 2, 3, 4, 5, 6\}$
 $P_1 = \frac{2}{9}$ $P_2 = \frac{1}{9}$

$$= \frac{2}{3} \log_2 \frac{9}{2} + \frac{1}{3} \log_2 9$$

$$F) = \frac{1}{2} \log 2 + \frac{1}{2} \log 10$$

maximum: $2\epsilon + 4\epsilon + 3\epsilon \leq$

$$P = \left(\frac{1}{6} \right)^6 + \dots + \left(\frac{1}{6} \right)^6$$

$$\ln P = 6 \ln \frac{1}{6} + \dots + 6 \ln \frac{1}{6}$$

$$\frac{\partial}{\partial a} (-a \ln a) = -\ln a - 1 = \lambda$$

$$c, a = e^{-1-\lambda}$$

$$a=b=c=d=e=f=\frac{1}{6}$$

Ans)

1-2

$0 \leq Y(x) \leq 1963$

$$P(x) \log_2 \left(\frac{1}{P(x)} \right) \geq 0$$

Q:

$$\sum_{x \in X} P(x) \log_2 \left(\frac{1}{P(x)} \right) \leq \log_2 (1)$$

Let $X \sim \text{Poisson}(\lambda)$ s.t.

$$H(X) = \sum_{i=1}^{\infty} \frac{1}{n} \log_2 n = \log_2 n$$

Let Y be r.v that takes values $1/p_i = 1/p_i$

$$\text{then } H(Y) = E(\log_2 Y) \leq \log_2 (E(Y)) = \log_2 n = H(X)$$

1-3

$$1) H(X) = 0.45 \log_2 \frac{1}{0.45} + 0.55 \log_2 \frac{1}{0.55}$$

$$H(Y) = 0.1 \log_2 \frac{1}{0.1} + 0.3 \log_2 \frac{1}{0.3}$$

$$2) H(X, Y) = 0.45 \log_2 \frac{1}{0.45} + 0.55 \log_2 \frac{1}{0.55}$$

$$+ 0.1 \log_2 \frac{1}{0.1} + 0.3 \log_2 \frac{1}{0.3}$$

$$3) Y=0 \rightarrow \frac{1}{11} \log_2 \frac{11}{1} + \frac{9}{11} \log_2 \frac{11}{9}$$

$$Y=1 \rightarrow \frac{1}{3} \log_2 \frac{3}{1} + \frac{2}{3} \log_2 \frac{3}{2}$$

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$$P(0,1) = 0.6 \times 0.55 = 0.33$$

$$r(1,0) = 0.4 \times 2.150 = 0.86$$

$$r(2,1) = 0.6 \times 0.45 = 0.27$$

$$p(20) = 0.4 \times 0.45 = 0.18$$

$$21 \times 1.37 = 0.45 \times 20.33 + 0.51 \times 20.71 + 0.14 \times 22 + 0.3 \times 24.18$$

5) $I(X;Y)$ 는 두 확률변수 X 와 Y 의
관계를 측정하는 척도

$$Z(x; y) = 0 \rightarrow x(y), y(x) \text{ sind SV}$$

$\mathbb{Z}(x) = \mathbb{Q}(x) \rightarrow$ \mathbb{Z} पर गुणन

2-11

$$\begin{pmatrix} 2-\lambda & 0 & 0 \\ 0 & 2-\lambda & 1 \\ 0 & 0 & 1-\lambda \end{pmatrix}$$

-1	0	0
1	1	1

$$h = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\hookrightarrow (2-x)(2-x)(1-x) = 1$$

$\lambda = 2$

人

$\frac{1}{2}$

$$\begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix}$$

99

(10)

$2 = 3$

$$B^T B = \begin{bmatrix} 1 & 4 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\lambda_1 = 1 \quad \lambda_2 = 2 \quad \lambda_5 = 0$$

$$w_1 = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \quad w_2 = \begin{pmatrix} -1 \\ 5 \\ 5 \end{pmatrix} \quad w_3 = \begin{pmatrix} 1 \\ 15 \\ 0 \end{pmatrix}$$

$$b_1 = 1 \quad b_2 = \sqrt{2} \quad b_3 = 0$$

$$U_1 = \frac{1}{\sigma_1} B W_1 = \frac{1}{1} \begin{pmatrix} 11 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 8 \\ 1 \end{pmatrix} = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$$

$$U_2 = \frac{1}{G_2} B m_2 = \frac{1}{G_2} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} \frac{1}{G_2} \\ \frac{1}{G_2} \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$u_2 \rightarrow \frac{1}{5} \quad V = (u_1, u_2) = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

$$B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 0 & 0 \\ 1 & 1 \end{pmatrix}$$

$$\Sigma = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$V = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$$

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3-1

1) $\ln x$: concave

$$(\ln x)'' = -\frac{1}{x^2} < 0$$

2) $\ln(1-x)$: concave

$$(\ln(1-x))'' = -\frac{1}{(1-x)^2} < 0$$

$\ln x + \ln(1-x) = \ln(x(1-x))$: concave

3-2

$$x_1 = \ln(0.5) - 0.2(1) = -0.92$$

$$x_2 = 0 - 0.2(1) = -0.2$$

3-3

$$\begin{aligned} 1) L(x, y, \lambda) &= f(x, y) + \lambda g(x, y) \\ &= x^2 + y^2 + \lambda(x + y - 2) \end{aligned}$$

$$2) \frac{\partial L}{\partial x} = 2x + \lambda$$

$$\frac{\partial L}{\partial y} = 2y + \lambda \Rightarrow \begin{aligned} x &= y = 1 \\ \lambda &= -2 \end{aligned}$$

$$\frac{\partial L}{\partial \lambda} = x + y - 2$$

3) $f(x, y)$ 의 최댓값은 $x=y=1$ 일 때

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