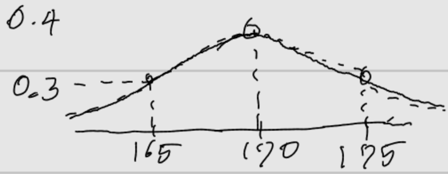
· 행렬에서 열(col)은 x축 행(row)은 y축

· 확률분포

ex) $X = \{x_1, ----, x_{100}\}$ $\Rightarrow$ $E[X] = \sum_{i=1}^{100} x_i \cdot P_X(x_i)$ $P_X(x_i)$: 확률

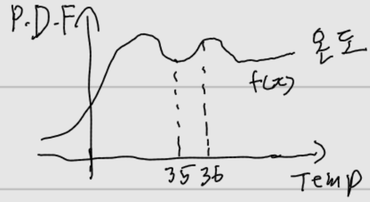
$= \{170, 160, 159, ----\}$ $V[X] = E[(x-\bar{x})^2] = E[x^2] - E[x]^2$

$E[X] = 170$



키 : 시간이나 온도같은 개념이 아님, 끊겨있음
↳ 이산확률분포

ex2)



온도 → 확률 $= \int_{35}^{36} f(x)\,dx$

· 공분산

$X = 키 = \{x_1, ---, x_n\}$ $\Rightarrow E[X], V[X]$

$Y = 몸무게 = \{y_1, ---, y_n\}$ $\Rightarrow E[Y], V[Y]$

$Z = \{z_1, ---- z_n\} \in R^2$ $z_i = (x_i, y_i)$

$\Rightarrow E[Z] = \begin{bmatrix} X \\ Y \end{bmatrix}$ $V[Z] \longleftrightarrow$ covariance(공분산)

etc) X, Y, K → $\begin{bmatrix} cov_{11} & cov_{12} & cov_{13} \\ & \ddots & \vdots \\ \cdots & \cdots & \end{bmatrix}$ ⇒ 공분산 행렬

· E와 V의 특징

$E[X]$

→ $E[\alpha x] = \alpha E[x]$ ex) $X = \{3, 4, 5\}$ $E[x] = 4$ $E[2x] = 8$
$2X = \{6, 8, 10\}$

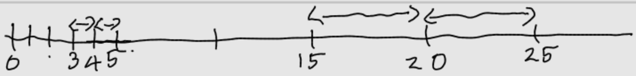
→ $E[X+Y] = E[X] + E[Y]$

→ $E[XY] = E[X] \cdot E[Y] + cov(X, Y)$ · X와 Y가 독립일 경우 $cov(X, Y) = 0$

$cov(X, Y) = E[XY] - E[X]E[Y]$

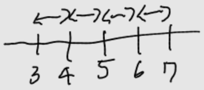
$V[X]$

$\rightarrow V[\alpha X] = \alpha^2 V[X]$ ex) $X=\{3,4,5\}$ $\alpha=5$ $\alpha X=\{15,20,25\}$



(간격차이 O)

$\rightarrow V[X+\beta] = V[X]$ ex) $X=\{3,4,5\}$ $\beta=2$ $X+\beta=\{5,6,7\}$



(간격 차이 X)

$\rightarrow V[X+Y] = V[X]+V[Y]+2COV(X,Y)$

· 공분산 2

X: 키 (170)   Y: 심장박동수 (200)   Z: 화장실 간 횟수 (10)   H: 식사 횟수 (5)

$COV(X,Y) = E[XY]-E[X]\cdot E[Y]$ $COV(X,X) = E[X^2]-E[X]^2 = V[X]$

$COV(Z,H) =$ 〃

· 상관계수(ρ) $-1 \le \rho_{XY} = \dfrac{COV(X,Y)}{\sqrt{V(X)V(Y)}} \le 1$ $\rho_{XX} = \dfrac{V[X]}{V[X]} = 1$ $\rho_{X,-X} = \dfrac{COV(X,-X)}{\sqrt{V(X)V(-X)}} = \dfrac{-V[X]}{V[X]} = -1$

·	X	Y	Z
E	μ_1	μ_2	μ_3
V	σ_1	σ_2	σ_3

공분산 행렬: $\begin{bmatrix} \Sigma_{11} & \Sigma_{12} & \Sigma_{13} \\ \Sigma_{21} & \Sigma_{22} & \Sigma_{23} \\ \Sigma_{31} & \Sigma_{32} & \Sigma_{33} \end{bmatrix} = \begin{bmatrix} \sigma_1^2 & \Sigma_{12} & \Sigma_{13} \\ \Sigma_{12} & \sigma_2^2 & \Sigma_{23} \\ \Sigma_{13} & \Sigma_{23} & \sigma_3^2 \end{bmatrix}$ $\rho_{12} = \dfrac{COV(1,2)}{\sqrt{V(1)V(2)}} = \dfrac{\Sigma_{12}}{\sigma_1\sigma_2}$

$\Downarrow$

$COV = \Sigma$

$\hookrightarrow \Sigma_{12} = \sigma_1\sigma_2\cdot\rho_{12}$