Lecture-1

*1 Probablity Value = $\dfrac{\text{the number of favourable outcome}}{\text{" total " " possible outcome}}$.

*2 Mutually Exclusive Events: No common possible outcome of two event.

Lecture-2

*1 Conditional probablity, $P(A|B) = \dfrac{P(A\cap B)}{P(B)}$ → Known.

*2 $P(A|$conditional On ≡ Given that$|B)$

I ~~III~~ Lasts long → (III, II, I), (II, III, I)

II not failing first → (III, II, I), (III, I, II), (I, II, III), (I, III, II)

I lasts longer than II → (I, II, III), (III, I, II), (I, III, II).

Lecture-3 (Descrete)

*1 PMF → (i) $0 \le P_i \le 1$, (ii) $\Sigma P_i = 1$. [২,৩টি কয়েন/coin throw করে ask করলে H/T আসার chance. ০টার, ১টার, ২টার..chance]

↳ $P(0), P(1), P(2)\dots$

*2 CDF → (Cumulative distribution func)

↳ $F(0) = P(0)$, $F(1) = P(0) + P(1)$, ~~F(2)~~ $F(2) = P(0) + P(1) + P(2) = F(1) + P(2) \dots$

Lecture-4 (continuous)

*1 PDF → $f(x)$ can be any func like, $f(x) = 1.5 - 6(x - 5.0)^2$

↳ (i) $f(x) \ge 0$ (ii) $\int_a^b f(x)\,dx = 1$ → [validity check or constant finding-এ কাজে লাগে]

*2 cumulative distribution func, cdf, $F(x) = \int_{l}^{x} f(x)\,dx$. (l = Lowest value)

*3 $P(x < 0.2) = \int_{l}^{0.2} f(x)\,dx$, $P(0.1 < x < 0.2) = \int_{0.1}^{0.2} f(x)\,dx$, $P(0.1 < x) = \int_{0.1}^{h} f(x)\,dx$ (h = highest point.)

Lecture-5

*1 Exception of a Random variable/ 'average'/ $E(x) = \Sigma\, x\, P(x)$ [descrete]

$E(x) = \int_{l}^{u} x\, P(x)\, dx$ [continuous]

*2 Variance (avg. point থেকে কতটা spread করে আছে তা),

descrete, $V(x) = E(x^2) - (E(x))^2 = \Sigma x^2 P(x) - (\Sigma x P(x))^2$

continuous, $V(x) = E(x^2) - (E(x))^2 = \int_{l}^{u} x^2 f(x)\,dx - \left(\int_{l}^{u} x f(x)\,dx\right)^2$

*3 Standard deviation, $SD(x) = \sqrt{V(x)}$

Lecture 6

*1 1st quartile / lower quartile (Q_1) : $F(x) = 0.25$
2nd quartile / Median (Q_2) : $F(x) = 0.50$
3rd " / Upper quartile (Q_3) : $F(x) = 0.75$

*1 $F(x) = \int_L^x f(x)\,dx$ = cdf.
*2 এরকম হিসাব equation আকারে 1 & calculator-এ solve করতে।
*3 যে value L থেকে U এর মধ্যে থাকলে সেটাকে $Q_1/Q_2/Q_3$.

*2 Inter Quartile Range (IQR) = $Q_3 - Q_1$

Lecture-7

*1 Jointly Probability Density Fun^c, JPDF → ① $f(x,y) \geq 0$ ② $\int_c^d \int_a^b f(x,y)\,dx\,dy$ [double integral]

*2 Marginal Probability Distribution

MPDF of x i) $g(x) = \int_c^d f(x,y)\,dy$ [x-এর একটা func আসবে] * [y-এর limit দেয়া আছে]
MPDF of y ii) $h(x) = \int_a^b f(x,y)\,dx$ [y-এর func আসবে]

*3 Conditional Probability. (The conditional distribution of the random variable Y, given that $X = x$ is, $f(y|x) = \frac{f(x,y)}{g(x)} = \frac{f(x=x,y)}{g(x)}$
variable X, given that $y = y$ is, $f(x|y) = \frac{f(x,y=y)}{h(y)}$

*4 statical Independence, [$f(x,y) = g(x)\,h(y)$] [prove/show করতে]

*5 Covariance, $cov(x,y) = E((x-E(x))(Y-E(y)))$
$= E(xY) - E(x)E(y)$

*6 Correlation, $corr(x,y) = \frac{cov(x,y)}{\sqrt{var(x)\,var(Y)}}$

*7 only Variance of x, $V(x) = E(x^2) - (E(x))^2$, variance of y, $V(y) = E(y^2) - (E(y))^2$

Lecture 8 Jointly Probability Mass fun^c.

① $0 \leq p_{ij} \leq 1$ ② $\sum\sum p_{ij} = 1$.

*1 Marginal distribution of x → $P(x=i) = \sum_{j=1}^{3} p_{ij} = p_{i1} + p_{i2} + p_{i3}$
$P(x=2) = \sum_{j=1}^{3} p_{2j} = p_{21} + p_{22} + p_{23}$

*2 Conditional Probability
x con... on Y, → $P(x|y=j) = \frac{P(x, Y=j)}{P(Y=j)}$

*3 E(Y) = $\sum_{j=1}^{3} j\,P(Y=j)$ ← M.G.F of Y.

$= 1\,P(Y=1) + 2P(Y=2) + 3P(Y=3)$

$E(Y^2) = \sum_{j=1}^{3} j^2 P(Y=j)$

$V(Y) = E(Y^2) - (E(Y))^2$

*4 (i) মধ্য Expectation হবে, $E(X) = \sum_{i=1}^{4} iP(X=i)$

(ii) Conditional এর ক্ষেত্রে, $E(X|Y=K) = \sum_{i=1}^{4} iP(X=i|Y=K)$

Relation

*1 cov(x,y) এর range : $-\infty < cov(x,y) < +\infty$ হবে $-1 \le corr(x,y) \le 1$.

*2 cov & corr → +ve হলে two variable are positively related. cov বা corr

*3 - - - - → -ve এর ক্ষেত্রে negatively এ cov & corr

*3 cov = 0, corr = 0 হলে no relation.