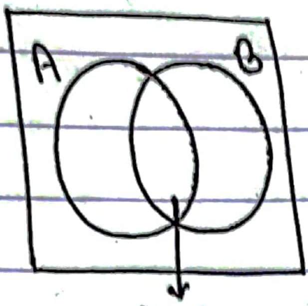
Conditional Probability:



$A \cap B$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

* Probability of A occuring such that B has already occurred.

Baye's Theorem:

$$P(A_i|B) = \frac{P(B|A_i) * P(A_i)}{P(B)}$$

$$P(B) = \sum_{i=1}^{n} P(B|A_i) * P(A_i)$$

$$P(A \cap B) = P(A|B) * P(B) = P(B|A) * P(A)$$

conditional probability = accepted outcomes / total outcomes

Geometric Distribution:

$$P(X=x) = (1-p)^{n-1} p^n$$

$$E(X) = \frac{1}{p}$$

$$Var(X) = \frac{1-p}{p^2} \text{ or } \frac{q}{p^2}$$
(σ^2)

Standard deviation (σ) = $\sqrt{\frac{1-p}{p^2}} = \sqrt{\frac{q}{p^2}}$

Binomial Distribution:

$$p(x; n, p) = \begin{cases} {}^nC_x p^x (1-p)^{n-x} \\ 0 \end{cases}$$

$E(X) = np$

$Var(X)$ (σ^2) $= np(1-p)$ or npq

Standard deviation $(\sigma) = \sqrt{np(1-p)}$ or $\sqrt{npq}$

Multinomial Distribution

$$\frac{n!}{m_1! m_2! m_3! \ldots m_k!} * p_1^{m_1} * p_2^{m_2} * p_3^{m_3} * p \ldots * p_k^{m_k}$$

Poisson Distribution

$$P(X=x) = \frac{e^{-\lambda} \lambda^x}{x!}$$ [λ = mean no. of occurrences, $e = 2.7183$]

Propositional Logic

Negation, $\neg p$ (NOT)

p	$\neg p$
T	F
F	T

Conjunction, $p \land q$ (AND)

p	q	$p \land q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction, $p \lor q$ (OR)

p	q	$p \lor q$
T	T	T
T	F	T
F	T	T
F	F	F

Exclusive OR (XOR)

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

- Contrapositive: $\neg q \rightarrow \neg p$
- Converse: $q \rightarrow p$
- Inverse: $\neg p \rightarrow \neg q$

Implication, $p \rightarrow q$

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

* Can be expressed as:

(1) if p, then q
(2) if p, q
(3) q if p
(4) p only if q
(5) p is sufficient for q
(6) p implies q
(7) q whenever p
(8) q is necessary for p
(9) q follows from p
(10) a necessary condition for p is q
(11) a ~~necessary~~ sufficient condition for p is q

Biconditional, $p \leftrightarrow q$

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

* can be expressed as:

(1) p if and only if q
(2) p is necessary and sufficient for q
(3) if p then q, and conversely
(4) p iff q

Propositional equivalences

Compound proposition	Name
only True	Tautology
only False	Contradiction
neither True / False	Contingency

Exclusive OR (XOR)

$p \oplus q$	p	q
F	T	T
T	F	T
T	T	F
F	F	F

$* \; P(x)$ — P → predicate, x → variable

propositional function

$p \leftrightarrow q$	p	q
T	T	T
F	F	
F	T	F
	F	F

Implication

$p \to q$	p	q
T	T	T
F	F	T
T	T	F
T	F	F

Quantification

Universal Quantifier

- $\forall(x)$
- all of, for each, given any, for arbitrary
- $\forall(x)P(x)$
  $\to P(x_1) \land P(x_2) \ldots \land P(x_k)$
- $\neg P(x_1) \lor \neg P(x_2) \ldots \lor \neg P(x_k)$

$* \; \neg\exists(x)P(x) \equiv \forall(x)\neg P(x)$

Existential Quantifier

- $\exists(x)$
- $\exists(x)P(x)$
  $\to P(x_1) \lor P(x_2) \ldots \lor P(x_k)$
- $\neg P(x_1) \land \neg P(x_2) \ldots \land \neg P(x_k)$

$* \; \neg\forall(x)P(x) \equiv \exists(x)$

Operator	Precedence
$\neg$	1
$\land$	2
$\lor$	3
$\to$	4
$\longleftrightarrow$	5

Linear homogenous recurrence relation

$a_n = c_1 a_{n-1} + c_2 a_{n-2} + \dots c_k a_{n-k}$

$a_n = \alpha_1 r_1^n + \alpha_2 r_2^n + \dots + \alpha_k r_k^n$

$r^k - c_1 r^{k-1} - c_2 r^{k-2} - \dots - c_k = 0$

Linear nonhomogenous recurrence relation

$a_n = c_1 a_{n-1} + c_2 a_{n-2} + \dots c_k a_{n-k} + f(n)$

~~$a_n^{(p)} =$ (in the table given below)~~

$r^k - c_1 r^{k-1} - c_2 r^{k-2} - \dots - c_k = f(n)$

$a_n = a_n^{(h)} + a^{(p)}$

$a_n^{(h)}$ = homogenous part

$a_n^{(p)}$ = particular part

$f(n)$	a_n
c	A
n	$A_1 n + A_0$
n^2	$A_2 n^2 + A_1 n + A_0$
b^n	Ab^n