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Stats: 9709 : Formula Sheet

Ch#. 1, 2, 3

Class boundary: 0-5, 5-10 $0 \le 5 < 10$

Class width: 0-4, 5-9 $0 \le 5 \le 9$

↳ correction factor = $\frac{\text{lower limit of 2nd class} - \text{upper limit of first class}}{2}$

added to upper limits / subtracted from lower limits

Ch1

For c.f graph: ≤ limit

Box plot: Normal distribution (symmetrical), Negative skew, +ve skew

Arithmetic Mean: $\bar{x} = \frac{\Sigma x}{n} = \frac{\Sigma f(x)}{\Sigma f}$

Σx sum of x, n sum of x; $\Sigma f(x)$ sum of f, Σf sum of f

$\bar{x} = A + \frac{\Sigma D}{n}$ where A is assumed mean & ΣD is sum of deviations

ΣD for $D = x - \bar{x}$ is 0.

Deviation $D = x - A$

Standard deviation formulae:

① $S.D = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n}}$

② $S.D = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2}$

③ $S.D = \sqrt{\frac{\Sigma x^2}{n} - (\bar{x})^2}$ (ungrouped)

④ $S.D = \sqrt{\frac{\Sigma f(x)^2}{\Sigma f} - \left(\frac{\Sigma f(x)}{\Sigma f}\right)^2}$

⑤ $S.D = \sqrt{\frac{\Sigma f(x)^2}{\Sigma f} - (\bar{x})^2}$ (grouped)

⑥ $S.D = \sqrt{\frac{\Sigma D^2}{n} - \left(\frac{\Sigma D}{n}\right)^2}$

⑦ $S.D = \sqrt{\frac{\Sigma f D^2}{\Sigma f} - \left(\frac{\Sigma f(D)}{\Sigma f}\right)^2}$

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Variance $s = S.D^2 = \frac{\Sigma x^2}{n}$

Combined Mean & S.D: $\bar{x} = \frac{\Sigma x + \Sigma y}{n_1 + n_2}$: $S.D_{com} = \sqrt{\frac{\Sigma x^2 + \Sigma y^2}{n_1 + n_2} - (\bar{x})^2}$

Properties of Arithmatic mean
① If $y = ax + b$, $\bar{y} = a + b\bar{x}$
② $\Sigma a = na$
$\therefore \Sigma(y = ax + b)$
$= \Sigma y = na + b\Sigma x$

e.g. q/s. $n = 10$, $\Sigma(x - 13) = 27$, Find $\bar{x}$
(1) Shortcut: $F = A + \frac{\Sigma D}{n}$ ...
(2) Coding method: $\because$ Let $y = x - 13$, $\therefore \Sigma y = 27$, $\therefore \bar{y} = \frac{\Sigma y}{n} = \frac{27}{10} = 2.7$
Then using property ② for $\bar{x}$
(3) Direct Method: 求 Σx
$\because \Sigma(x - 13) \Rightarrow \Sigma x - 13(10) = 27$
$\therefore \Sigma x = 157$
Then use $\bar{x} = \frac{\Sigma x}{n}$ for $\bar{x}$

S.D (a) and Variance (a) $= 0$ where a is constant
$\because S.D(x \pm a) = S.D(x) \pm S.D(a)$, $S.D(a) = 0$
$\therefore S.D(x) = S.D(x \pm a)$
$\therefore$ Variance (x) = Variance $(x \pm a)$

Equally likely event: $P(A) = P(B)$
~~not~~ ~~mutually exclusive/disjoint~~ Not exclusive event: $A \cap B = \{\}$
exclusive event: $A \cap B \neq \{\}$
Addition law $\Rightarrow$ exclusive: $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B)$
not exclusive: $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(\text{common})$

Independent event: $P(A \cap B) = P(A) \times P(B)$
Conditional Probability: $P(A/B) = \frac{P(A \cap B)}{P(B)}$ (B given)

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Factorial => eg. 4! => 4x3x2x1

0! => always = 1

Ch 2

Order effects result -> Permutation

" doesn't " " => combination

R! => No. of possible arrangements of R different items

n items with some repeats => $\frac{n!}{(\text{repeated 1 count})! \times (\text{repeated 2 count})! \dots}$

Permutation : ${}_n P_r$ → no. of spaces ${}_n P_r = \frac{n!}{(n-r)!}$

↳ no. of items

Combination : ${}_n C_r$ → to set no. to select/choose/draw

↳ no. of items

${}_n C_r = \frac{n!}{r!(n-r)!}$

eg. Q2 REFRIGERATOR => Select 4 letters, with exact 2 E's and no R's

∴ Total = 4

R = 1, E = 2, Others = 6

"EE" $\binom{6}{2}$ = 15

eg. TELEPHONE with PG Lateral

P(___)L

switch = 4

Total 9, E=3 ∴ $\frac{7!}{3!} \times 2! = 1680$

7 letters, and above pair of same letter

If no restrictions in last part 1, then it means no restriction that what

eg. for same TELEPHONE, no restriction, find all words above of E

∴ "E" $\binom{6}{3}$ + "EF" $\binom{6}{2}$ + "EEE" $\binom{6}{1}$ = 41

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Ch 3

- freq. dist. table :

x	F

- Probability distribution

x	P(x)

$$\text{Mean} = E(x) = \frac{\Sigma x P(x)}{\Sigma P(x)}, \quad \Sigma P(x) \text{ always} = 1$$

$$\therefore E(x) = \Sigma x P(x)$$

$$\text{Variance} = \text{Var}(x) = \frac{\Sigma x^2 P(x)}{\Sigma P(x)} - \left(\frac{\Sigma x P(x)}{\Sigma P(x)}\right)^2, \quad \Sigma P(x) = 1$$

$$\therefore \text{Var}(x) = \Sigma x^2 P_x - (\Sigma x P(x))^2 \text{ or}$$

$$\text{Var}(x) = \Sigma x^2 P(x) - (E(x))^2$$

$$\text{S.D}(x) = \sqrt{\text{Var}(x)}$$

$$P(x) = \frac{\binom{k}{x}\binom{N-k}{n-x}}{\binom{N}{n}}$$

where N = Total
k = interest
n = select/drawn/chosen/taken
$x = 0$ to smallest of n or k