CS & IT ENGINEERING

DISCRETE MATHS
SET THEORY

[redacted]

Lecture No. 4

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TOPICS TO BE COVERED

01 onto Functions

02 1:1 correspondance Functions

03 Number of Functions

04 Types of Functions

05 Various Examples in Functions

Functions

$A = 7 \quad B = 4$

$m = 7 \quad n = 4.$

$$\sum_{i=0}^{n} (-1)^i * {}^nC_i * (n-i)^m = \sum_{i=0}^{4} (-1)^i * {}^4C_i * (4-i)^7$$

Ans: $\underline{8400}$

$$= {}^4C_0(4-0)^7 - {}^4C_1(4-1)^7 + {}^4C_2(4-2)^7 - {}^4C_3(4-3)^7 + {}^4C_4(4-4)^7$$

Functions

different → diff.

m diff → n diff boxes.

→ How many ways we can distribute 7 diff coins among 4 diff holes, such that none of the holes should be empty?

7 quest → 4

Functions

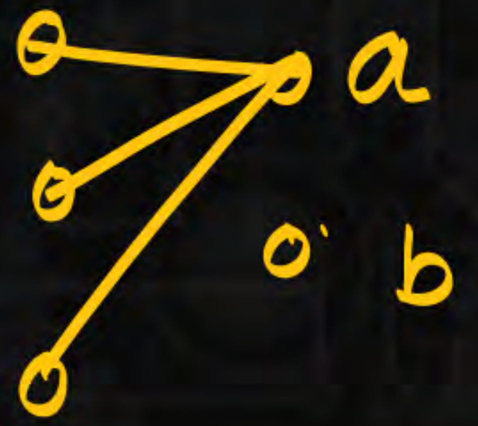
$m = 3 \quad n = 2.$ Total onto functions

$$= \sum_{i=0}^{2} (-1)^i * 2_{C_i} * (2-i)^m$$

$$= 2_{C_0}(2-0)^3 - 2_{C_1}(2-1)^3 + 2_{C_2}(2-2)^3$$

$$= 2^3 - 2 \cdot 1^3 + 0 = 8 - 2 = 6 \text{ onto functions}$$

Functions



Total onto = Total Functions − Total non onto.

$$= 2^3 - 2 = 8 - 2 = 6.$$

onto :

diff quest → diff room

Functions

$S(m,n) = \dfrac{\text{onto}}{n!}$

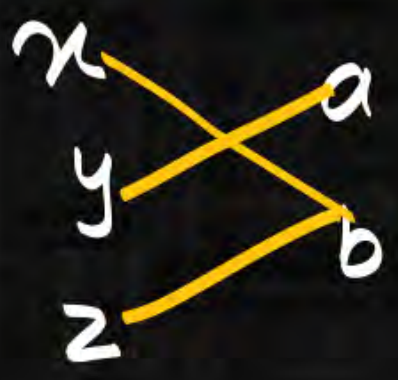
diff → identical.

diff → diff.

$\dfrac{6}{2} = \dfrac{\text{onto}}{2!}$ $[xy]\,[z]$

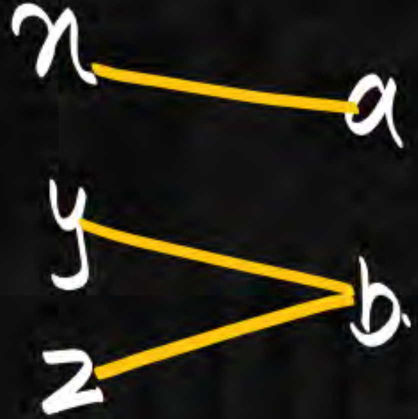
$[xy]_a\,[z]_b$

$[xz]_b\,[y]_a$



$[xy]_b\,[z]_a$

$[xz]_a\,[y]_b$



$[xy]_a\ \ [z]_b$

$[xy]_b\ \ [z]_a$

$[xz]\,[y]$

$[xz]_b\ \ [y]_a$

$[xz]_a\ \ [y]_b$

$[yz]\,[x]$

Functions

$m \rightarrow$ diff objects $\longrightarrow n$ identical rooms.

onto $= n! \times \underbrace{S(m,n)}$

$= \dfrac{\text{onto}}{n!}$

Stirling number of second kind.

$$S(m,n) = \frac{1}{n!}\sum_{i=0}^{n} (-1)^i * {}^nC_i * (n-i)^m$$

Functions

$L_1 = L_2 = L$. 2 identical

$$\frac{3!}{2!}$$

$3!$ $\begin{cases} A L_1 L_2 \\ A L_2 L_1 \\ L_1 A L_2 \\ L_2 A L_1 \\ L_1 L_2 A \\ L_2 L_1 A \end{cases}$

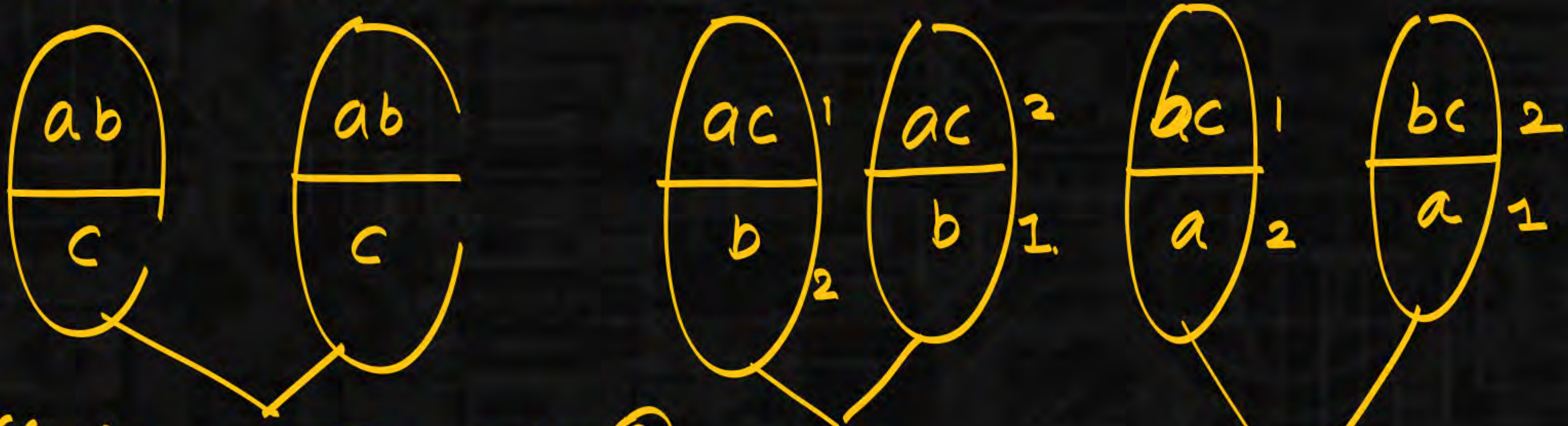
$A L_1 L_2,\ A L_2 L_1 \to ALL$

$L_1 A L_2,\ L_2 A L_1 \to LAL$

$L_1 L_2 A,\ L_2 L_1 A \to LLA$

Functions

1=2 3 diff elements → 2 diff rooms → **Ans** : 6.



3diff **Ans**: 3.

→ 2 identical.

$= 3 = \frac{6}{2!}$

Functions

$A = \{1, 2, 3, 4\}$

$B = \{1, 2, 3, 4, 5, 6\}$.

$f: A \to B$ $\quad B^A = 6^4$.

Q.1. How many function from $A \to B$

2. how many these are 1:1 $^{R.S}P_{L.S}$ $\quad {}^6P_4$.

3. How many these are onto. $\to 0$

$f: B \to A$ $\quad B \to n$ $\quad RS^{LS} \to A^B$

Q.4. how many functions from $B \to A$ $\quad 4^6$.

Q.5 — 1:1 $\to 0$

Q.6 $\to$ onto.

$m = 6 \quad n = 4$.

Functions

Q.1: How many ways we can distribut 7 diff quest to 4 diff rooms such that none of rooms should be empty.

onto:

Onto: $m=7$ $n=4$.

Ans: 8400

Q.2: How many ways we can distribute 7 diff quest → 4 identical rooms.

none of rooms should be empty.

$S(m,n)$

$$S(m,n) = S(7,4) = \frac{\text{onto}}{4!}$$

$$= \frac{8400}{4!}$$

Functions

$f: R \to R \ (a, b, c, f)$

1:1/onto

a) $f(x) = x + 7 \to$ 1:1/onto

b) $f(x) = 2x - 3$ 1:1 | but not onto Range: odd no.

c) $f(x) = -x + 5$ / 1:1/onto

d) $f(x) = x^2$ not 1:1/not onto

e) $f(x) = x^2 + x \to$ not 1:1/not onto

f) $f(x) = x^3$ 1:1/but not onto

$x = 2$

$2(2) - 3$

1

$2 \longrightarrow 1$

$\longrightarrow 3$

$a \longrightarrow 2a - 3$

$x \longleftarrow y$

$y = 2x - 3$

$y + 3 = 2x$

$\frac{y+3}{2} = x$

$y = 1 \quad \frac{1+3}{2} = 2$

$f(0) = f(-1)$

$0 + 0 = 1 + (-1)$

$0 = 0$

$f(0) = f(-1) \longrightarrow 0 = -1$


THANK YOU GW
SOLDIERS !