SCHOOL OF COMPUTING

SESSION 2019/2020 SEMESTER 2

SCSI1013 - 06

Discrete Structure

63/67

Tutorial 2.1

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1. $P(4) = 4!$

$= 4 \times 3 \times 2 \times 1$

$= 24$

2

2. $P(5,3) = \frac{5!}{(5-3)!}$

$= \frac{5.4.3.2.1}{2.1}$

$= 5.4.3$

$= 60$

2

3. Indescretness

14 letters I(1), N(2), D(1), E(4), S(3), C(1), R(1), T(1)

$P(14) = \frac{14!}{(1!\,2!\,1!\,4!\,3!\,1!\,1!\,1!)}$

$= 302702400$

2

4. $P(12,7) = \frac{12!}{(12-7)!}$

$= 3991680$

2

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5. $P(26,10) = \frac{26!}{(26-10)!}$

$= \frac{26!}{16!}$

$= 19275223968000$

2

6. $C(9.1) = \frac{9!}{1!\,8!}$

$= 9$

1

7. a) $C(13,5) = \frac{(13)!}{5!\,8!}$

$= 1287$

1

b) $C(5,1) = 5$, $C(3,1) = 3$, $C(3,1) = 3$, $C(2,1) = 2$

$5 \cdot 3 \cdot 3 \cdot 2 = 90$

2

c) $C(5,2) = 10$, $C(3.2) = 3$, $C(3,1) = 3$

$10 \cdot 3 \cdot 3 = 90$

2

d) $C(5,1) = 5$, $C(3,1) = 3$, $C(3,1) = 3$ $C(2,1) = 2$

$5 \cdot 3 \cdot 3 \cdot 2 = 90$

$C(5,1) = 5$, $C(3,1) = 3$, $C(3,2) = 3$

$5 \cdot 3 \cdot 3 = 45$

$90 + 45 = 135$

5

8. a. $(5-1)! = 24$ 2

b. $(4-1)! = 6$ 2

$6 \cdot 2 = 12$

c. $(3 \cdot 1)!\ 3! = 3!\ 2!$

$= 12$ 5

d. $P(5,3) = \frac{(5)!}{(5-3)!}$

$= \frac{5!}{2!}$ 2

$= 60$

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9.

a) $C(17,12) = \frac{17!}{12!5!}$

$= 6188$

✓ 2

b) egg bagel + pampernickel bagels + salty bagels = 7

condition = 3 egg bagels + no more than 2 salty bagels

3 egg bagels, 2 salty bagels, 2 pampernickel bagels

3 egg bagels, 1 salty bagels, 3 pampernickel bagels.

$C(3,3) = \frac{3!}{3!0!} = 1$ · $C(4,2) = \frac{4!}{2!2!} = 6$ $C(4,2) = \frac{4!}{2!2!} = 6$

$1 \cdot 6 \cdot 6 = 36$

✓ 2

$C(3.3) = \frac{3!}{3!0!} = 1$ $C(4,1) = \frac{4!}{1!3!} = 4$, $C(4,3) = \frac{4!}{3!1!} = 4$

$1 \cdot 3 \cdot 3 = 9$ ✗

$9 + 36 = 45$ ✗

10.

a) $C(10,6) = \frac{10!}{6!4!}$

$= 210$

$C(12,6) = \frac{12!}{6!6!}$

$= 924$

$210 \cdot 924 = 194040$

2

b)

7 computers science majors, 5 mathematics majors

8 computer science majors, 4 mathematics majors

9 computer science majors, 3 mathematics majors

10 computer science majors, 2 mathematics majors

$C(12,7) = \frac{12!}{7!5!} = 792$ $\qquad C(10,5) = \frac{10!}{5!5!} = 252$

$792 \cdot 252 = 199584$

$C(12,8) = \frac{12!}{8!4!} = 495.$ $\qquad C(10,4) = \frac{10!}{4!6!} = 210$

$495 \cdot 210 = 103950$

$C(12,9) = \frac{12!}{9!3!} = 220$ $\qquad C(10,3) = \frac{10!}{3!7!} = 120$

$220 \cdot 120 = 26400$

$C(12,10) = \frac{12!}{10!2!} = 66$ $\qquad C(10,2) = \frac{10!}{2!8!} = 45$

$66 \cdot 45 = 2970$

$C(12,11) = \frac{12}{11!1!} = 12$ $\qquad C(10,1) = \frac{10!}{9!1!} = 10$

$12 \cdot 10 = 120$

10

$C(12,12) = \frac{12!}{12!\,0!} = 1$

$199584 + 103950 + 26400 + 2970 + 120 + 1 = 333025$

11. Let marbles be the pigeons and colours be the pigeonholes.

No. of pigeonholes (colours) = 5

$k = 4$

$n = m(k-1) + 1$

$= 5(4-1) + 1$

$= 5(3) + 1$

$= 16$

2

12. By using pigeonholes principle.

Let the scores be the pigeonholes and the students be the pigeons.

No. of pigeonholes (score) = 101

By using pigeonholes principle,

$k = \left\lceil \frac{n}{m} \right\rceil$

$2 = \left\lceil \frac{n}{101} \right\rceil$

The total number of student must be at least $N = (101 \cdot 1) + 1 = 102$

Since pigeons must be greater than the pigeonholes.

the number of students is 102.

3

Let the grades be the pigeonholes and the students be the pigeons.

No. of pigeonholes (score) $m = 5$

By using pigeonholes principle,

$k = \left\lceil \frac{n}{m} \right\rceil$

$6 = \left\lceil \frac{n}{5} \right\rceil$

The total number of student must be at least

$N = (5 \cdot 5) + 1$

$= 26$

Since pigeons must be greater than the pigeonholes, the number of student is 26

3

4. Let the computers be the pigeons and the number of direct connections be the pigeonholes.

Since each computer is directly connected to at least one of my other computers, there are five possibilities ({1}, {2}, {3}, {4}, {5})

No. of pigeonholes (number of direct connections)

$m = 5$

No. of pigeons (number of computers), $n = 6$

$K = \lceil \frac{n}{m} \rceil = \lceil \frac{6}{5} \rceil = 2$

Since pigeonholes > pigeons, at least two computers in the network that are directly connected to the same number of other computers.

3

19.

A bowl contain 10 red marble and 10 blue marbles. A girl selects marbles at random without ~~col~~ replacement

a) getting 3 marbles of same color.

pigeonhole = number of colour = 2

10 red marbels and 10 blue marbels.

3 red + 3 blue ~~++~~ − 2 + 1

= 6 − 2 + 1

= 5

Ans: 5

3

b) The least number of marbles must she select to be sure of getting a least 3 blue marbles is 10 + 3 = 13

Ans: 13

1