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IN SLIDE EXERCISE FOR CHAPTER 3

GROUP 5

SECTION 03 - SEM 1, 2024/2025

SECI1013 (*DISCRETE STRUCTURE*)

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“Defining boundaries, expanding possibilities.”

PART 1

Exercise 1

- There are 8 male students and 21 female students in Discrete Structure class. Among all of them, 7 students are Chinese and the rest are Malay.
 - In how many ways can we select 1 student - a boy or a girl?
 - In how many ways can we select 1 student - a Chinese or a Malay?



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ANSWER:

Exercise 1	
i) $T_1 = 8$	number of ways is $8+21 = 29$ ways
$T_2 = 21$	
ii) $n_1 = 7$	number of ways is $7+22 = 29$ ways
$n_2 = 22$	



Exercise 2

How to find the number of integers between 5 and 50 that end with 1 or 7.

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ANSWER:

$$\begin{aligned}\text{Integers end with 1} &= \{11, 21, 31, 41\} &= 4 \\ \text{Integers end with 7} &= \{7, 17, 27, 37, 47\} &= 5\end{aligned}$$

$$\begin{aligned}\text{Number of integers between 5 and 50 that end with 1 or 7} &= 4 + 5 \\ &= 9 \text{ ways}\end{aligned}$$



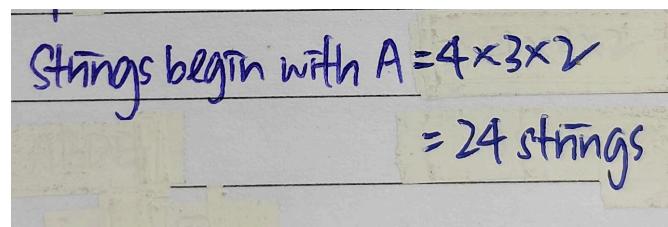
Exercise 3

The letters A, B, C, D, and E are to be used to form strings of length 4. How many strings begin with A, if repetitions are not allowed?
For example: ADEC, ACBD, AEBC ..

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ANSWER:



Strings begin with A = $4 \times 3 \times 2$
= 24 strings

Exercise 4

- There are 8 male students and 21 female students in Discrete Structure class. Among all of them, 7 students are Chinese and the rest are Malay.
 - In how many ways can we select 2 students - a boy and a girl?
 - In how many ways can we select 2 students - a Chinese and a Malay?



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ANSWER:

Male=8 Female=21

Chinese=7 Malay=22

- a) T1=8, T2=21
Number of ways; $8 \times 21 = 168$
- b) T1=7, T2=22
Number of ways; $7 \times 22 = 154$

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Exercise 5

A six-person committee composed of Aina, Wan, Chan, Tan, Syed and Helmi is to be selected to hold as a chairperson, secretary, and treasurer.

3. In how many ways can this be done if Syed must hold one of the position?
4. In how many ways can this be done if Tan and Helmi must hold any position?

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ANSWER:

	Exercise 5
	3) $\underline{5} \underline{5} \underline{4}$ $\underline{5} \underline{5} \underline{4}$ $\underline{5} \underline{4} \underline{5}$ + + $T_1 : 5$ $\therefore 3$ ways can be done $T_2 : 4$ In $3 \times 20 + 20 + 20 = 60$ ways $5 \times 4 = 20$ ways
	4) $\begin{array}{c c c c c c} T & H & I & H & I & T \\ \hline 4 & & 4 & & 4 & 4 \end{array}$ 6 cases each case 4 ways Total ways is $6 \times 4 = 24$ ways



Exercise 6

How many ways can we select three books each from a different subject from a set of six distinct history books, nine distinct classics books, seven distinct law books, and four distinct education books?

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ANSWER:

History book = 6
Classic book = 9
Law book = 7
Education book = 4

Ways to select three books from different subject:

$$\begin{aligned} & (6 \times 9 \times 7) + (6 \times 9 \times 4) + (9 \times 7 \times 4) + (6 \times 7 \times 4) \\ &= 378 + 216 + 252 + 168 \\ &= 1014 \text{ ways} \end{aligned}$$

PART 2



Exercise 1

In how many dance pairs (dance pairs means a pair (W,M), where W stands for a women and M for man), can be formed from a group of 6 women and 10 men?

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ANSWER:

$$\begin{aligned} \text{Number of dance pairs} &= 6 \times 10 \\ &= 60 \end{aligned}$$



Exercise 2

- In how many ways can 10 distinct books be divided among 3 students if Khairin gets 4 books and Nurina and Sarah each get 3 books.

Find the answer.

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ANSWER:

n=10, n1=6, n2=3, n3=3

$$P(10) = \frac{10!}{6!3!3!} = 4200$$



Exercise 3

- In how many ways can five people A, B, C, D, and E be seated around a circular table if
 - A and B must sit next to each other
 - A and B must not sit next to each other
 - A and B must be together and CD must be together

ANSWER:

	Exercise 3
a)	A B left 3 seat exclude AB $2 \quad 80, (4-1)! = 3! = 6$
	Total ways = $6 \times 2 = 12$ ways
b)	<u>A B</u> left 3 seats OR Total ways $\frac{2}{2} \quad (4-1)! = 3! = 6$ $(5-1)! = 4!$ Total is 12 ways = 24
c)	AB, CD, E $2 \quad 2$ $(3-1)! = 2!$ $= 2$ Total = $2 \times 2 \times 2$ $= 8$ ways



Exercise 4

A student is required to answer 7 out of 12 questions, which are divided into two groups, each containing 6 questions. The student is not permitted to answer more than 5 questions from either group. In how many different ways can the student choose the 7 questions?

ANSWER:

To answer 5 questions from Group 1 and 2 question from Group 2:

$$\left(\frac{6!}{5!(6-5)!} \right) \left(\frac{6!}{2!(6-2)!} \right) = 90 \text{ ways}$$

To answer 4 questions from Group 1 and 3 question from Group 2:

$$\left(\frac{6!}{4!(6-4)!} \right) \left(\frac{6!}{3!(6-3)!} \right) = 300 \text{ ways}$$

To answer 3 questions from Group 1 and 4 question from Group 2:

$$\left(\frac{6!}{3!(6-3)!} \right) \left(\frac{6!}{4!(6-4)!} \right) = 300 \text{ ways}$$

To answer 2 questions from Group 1 and 5 question from Group 2:

$$\left(\frac{6!}{2!(6-2)!} \right) \left(\frac{6!}{5!(6-5)!} \right) = 90 \text{ ways}$$

Total different ways for the student to choose the 7 questions = $90 + 300 + 300 + 90 = 780$ ways



Exercise 5

There is a box containing identical blue, green, pink, yellow, red and dark blue balls. In how many ways we can select 4 balls?



ANSWER:

$$n=6 \ r=4$$

$$\begin{aligned}\text{Number of Ways} &= C(n+r-1, n-1) \\ &= C(6+4-1, 6-1) \\ &= C(9, 5) \\ &= {}^9C_5 \\ &= \frac{9!}{5!4!} \\ &= 126\end{aligned}$$

PART 3



Exercise 1

- How many students must be in a course to guarantee at least two students receive same score in the test, if the test is graded on a scale from 0 to 100. Explain your answer.

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ANSWER:

Pigeon (n) = number of students?

Pigeonhole (m) = 101 (grades)

k = 2

$$n = m(k-1) + 1 = 101(2-1) + 1 = 102$$



Exercise 2

- Show that every set of 15 socks chosen among 14 pairs of socks contains at least one matched pair.

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ANSWER:

n =minimum number of socks to guarantee to get at least one matched pair of socks.

$m=14$ pairs of socks

$k=2$ (one matched pair of socks)

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

$n=14(2-1)+1=15$

If we choose 14 pairs of socks there's a low possibility to get at least one matched pair but when we add 1 pair of socks that makes it guaranteed to contain at least one matched pair of socks. So, 15 pairs of socks will have at least one matched pair of socks.

PART 4



Exercise 1

There are exactly 3 red balls in a bucket of 15 balls. If we choose 4 balls at random, what is the probability that we do not choose a red ball?

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ANSWER:

Total balls = 15

Total balls not including red ball = 12

Balls to be chosen = 4

The probability that we do not choose a red ball:

$$\frac{C(12,4)}{C(15,4)} = 0.36263736264$$



Exercise 2

What is the probability that if a fair coin is tossed 6 times you will get,

- i) Less than 2 heads
- ii) At least 2 heads

ANSWER:

$$\begin{aligned}
 & \text{Let } H = \text{getting less than 2 heads} \& S = \text{sample Space} \\
 & \text{(i) Probability to get a tail} = \frac{1}{2} \\
 & H = \{TTTTTT, HTTTTT, THTTTT, TTHTTT, TTTHTT, \\
 & \quad TTTTHT, TTTTTH\} \\
 & |H| = 7 \quad P(H) = \frac{|H|}{|S|} \\
 & |S| = 2^6 \quad = \frac{7}{64} \\
 & \quad = 64 \\
 & \text{(ii) } P(S) = 1 \quad P(H') = P(S) - P(H) \\
 & \quad P(H) = \frac{7}{64} \quad = 1 - \frac{7}{64} \\
 & \quad \quad \quad = \frac{57}{64}
 \end{aligned}$$

Exercise 3

On New Year's Eve, the probability of a person having a car accident is 0.09. The probability of a person driving while intoxicated is 0.32 and probability of a person having a car accident while intoxicated is 0.15. What is the probability of a person driving while intoxicated or having a car accident?

**ANSWER:**

Car accident = 0.09 (A)

Intoxicated = 0.32 (B)

Accident while intoxicated = 0.15 (C)

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.09 + 0.32 - 0.15 = 0.26$$



Exercise 4

Weather records show that the probability of high barometric pressure is 0.85 and the probability of rain and high barometric pressure is 0.15. What is the probability of rain given high barometric pressure?

ANSWER:

$$P(\text{high barometric pressure}) = 0.85$$

$$P(\text{rain and high barometric pressure}) = 0.15$$

$$P(\text{rain given high barometric pressure}) = P(\text{rain and high barometric pressure}) / P(\text{high barometric pressure})$$

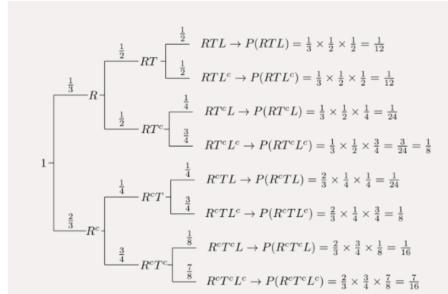
$$P(\text{rain given high barometric pressure}) = 0.15 / 0.85 = 3/17$$

Exercise 5

c) Given that I arrived late at work, what is the probability that it's rained that day?

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Let, R = event of rainy,
T = event of heavy traffic,
L = event of I'm late to work



ANSWER:

$$P(R|L) = \frac{P(R \cap L)}{P(L)}$$

$$\begin{aligned} P(R \cap L) &= P(RTL) + P(RT^cL) \\ &= \frac{1}{12} + \frac{1}{24} \\ &= \frac{1}{8} \end{aligned}$$

$$\begin{aligned} P(L) &= P(RTL) + P(RT^cL) + P(R^cTL) + P(R^cT^cL) \\ &= \frac{1}{12} + \frac{1}{24} + \frac{1}{24} + \frac{1}{16} \\ &= \frac{11}{48} \end{aligned}$$

$$P(R|L) = \frac{1/8}{11/48} = \frac{6}{11} @ 0.545454$$



Exercise 6

- Hana, Amir and Dani write a program that schedule tasks for manufacturing toys.
- The table shows the percentage of code written by each person and the percentage of buggy code for each person.

	Coder		
	Hana	Amir	Dani
% of code	30	45	25
% of bugs	3	2	5

- Given that a bug was found, **find the probability that it was in the program code written by Dani.**

ANSWER:

Let H = Code written by Hana,
A = Code written by Amir,
D = Code written by Dani and
B = Buggy code.

$$P(H) = \frac{30}{100} \quad P(A) = \frac{45}{100} \quad P(D) = \frac{25}{100}$$

$$= 0.3 \quad = 0.45 \quad = 0.25$$

$$P(B|H) = \frac{3}{100} \quad P(B|A) = \frac{2}{100} \quad P(B|D) = \frac{5}{100}$$

$$= 0.03 \quad = 0.02 \quad = 0.05$$

$$P(H|B) = \frac{P(B|H)P(H)}{P(B|H)P(H) + P(B|A)P(A) + P(B|D)P(D)}$$

$$= \frac{(0.03)(0.3) + (0.02)(0.45) + (0.05)(0.25)}{(0.03)(0.3) + (0.02)(0.45) + (0.05)(0.25)}$$

$$= \frac{0.009}{0.0305}$$

$$= \frac{18}{61}$$

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Exercise 7

- Halim and Aina take a final examination in Fortran.
- The probability that Halim passes is 0.85, and the probability that Aina passes is 0.70.
- Assume that the events "Halim passes the final exam" and "Aina passes the final exam" are independent.

- Find the probability that Halim does not pass.
- Find the probability that both pass.
- Find the probability that both fail.
- Find the probability that at least one passes.

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ANSWER:

Exercise 7

a) Let $H = \text{Halim passes}$
 $A = \text{Aina passes}$

$$\begin{aligned} P(H') &= 1 - 0.85 \\ &= 0.15 \end{aligned}$$

b) $P(H \cap A) = P(H) \cdot P(A)$
 $= 0.85 \cdot 0.70$
 $= 0.595$

c) $P(A') = 1 - 0.7$
 $= 0.3$

$$\begin{aligned} P(H' \cap A') &= P(H') \cdot P(A') \\ &= 0.15 \cdot 0.3 \\ &= 0.045 \end{aligned}$$

d) $1 - P(H' \cap A') = 1 - 0.045$
 $= 0.955$