MANIPAL UNIVERSITY JAIPUR

(University under Section 2(f) of the UGC Act)

B.TECH FIRST YEAR

ACADEMIC YEAR: 2020-2021

COURSE NAME: BASIC MECHANICAL ENGINEERING

COURSE CODE : MA 2101

LECTURE SERIES NO : 23 (TWENTY THREE)

CREDITS : 03

MODE OF DELIVERY : ONLINE (POWER POINT PRESENTATION)

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PROPOSED DATE OF DELIVERY: 14 OCTOBER 2020

MANIPAL UNIVERSITY JAIPUR

VISION

Global Leadership in Higher Education and Human Development

MISSION

- Be the most preferred University for innovative and interdisciplinary learning
- Foster academic, research and professional excellence in all domains
- Transform young minds into competent professionals with good human values

VALUES

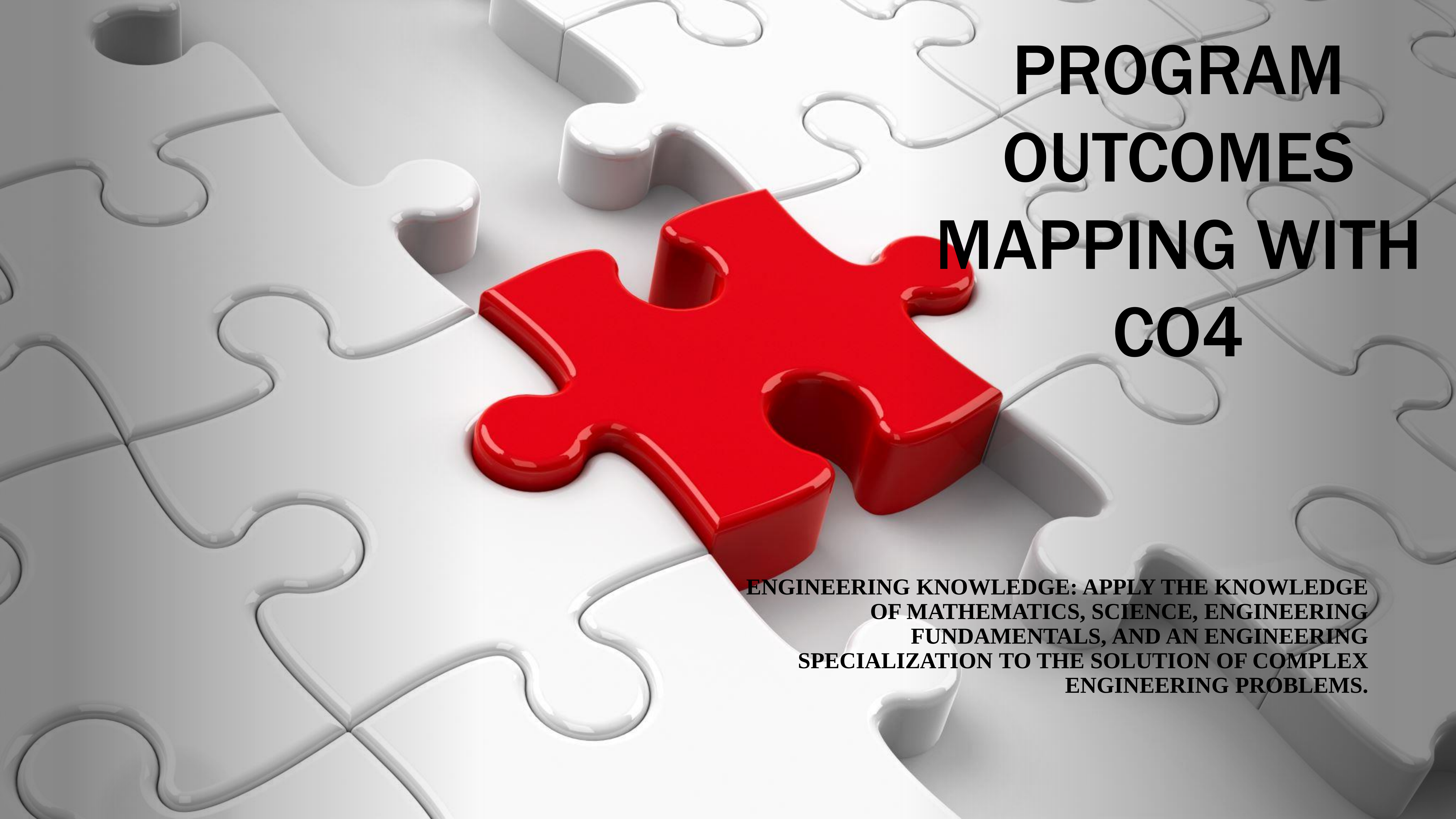
Integrity, Transparency, Quality,
Team Work, Execution with Passion, Humane Touch

SESSION OUTCOME

"UNDERSTAND THE FUNDAMENTAL CONCEPTS OF PERMUTATION AND COMBINATION"

ASSESSMENT CRITERIA'S

- ASSIGNMENT
- QUIZ
- MID TERM EXAMINATION –I, II
- END TERM EXAMINATION



PROGRAM OUTCOMES MAPPING WITH CO4

ENGINEERING KNOWLEDGE: APPLY THE KNOWLEDGE OF MATHEMATICS, SCIENCE, ENGINEERING FUNDAMENTALS, AND AN ENGINEERING SPECIALIZATION TO THE SOLUTION OF COMPLEX ENGINEERING PROBLEMS.

COMBINATIONS

Combinations: Each of the different groups or selections which can be formed by taking some or all of a number of objects, irrespective of their arrangements, is called a combination. The total number of combinations of n objects taking r $(\mathbf{1 \leq r \leq n})$ at a time is denoted by C(n, r) or $\,^{n}C_{r}$ or $\binom{n}{r}$.

Where $\,^{n}C_{r}$ is defined only when n and r integrals such that $(\mathbf{n \geq r})$ and n>0, $\mathbf{r \geq 0}$.

Suppose we have 3 teams . A,B and C. By permutation we have

$$^3P_2 = 6.$$

But team AB and BA will be the same.

Similarly BC and CB will be the same.

And AC and CA are same.

Thus actual teams = 3.

This is where we use combinations.

$$^nC_r = \frac{n!}{r!(n-r)!}$$

(Where 0< r ≤ n)

Identity 1: Let $0 \leq r \leq n$ $then$ $\;^nC_r = \;^nC_{n-r}$

Identity 2 : $\;^nC_r + \;^nC_{r-1} = \;^{(n+1)}C_r$

Identity 3 : If $(1 \leq r \leq n)$, $n \times^{(n-1)} C_{r-1}$ = (n-r+1) $\times^n C_{r-1}$

Identity 4 : If n and r are positive integers such that

$(1 \leq r \leq n)$ then $\frac{^nC_r}{^nC_{r-1}} = \frac{n-r+1}{r}$

Identity 5 : If $(1 \leq r \leq n)$,

then $\;^nC_r + \;^nC_{r+1} = \;^{(n+1)}C_{r+1}$

Example

Combinations

A student must answer 3 out of 5 essay questions on a test. In how many different ways can the student select the questions?

$$^{5}C_{3} = \frac{5!}{3!(5-3)!} = \frac{5!}{3!2!} = \frac{5*4}{2*1} = 10$$

Example

Combinations

A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting line up of one center, two forwards, and two guards?

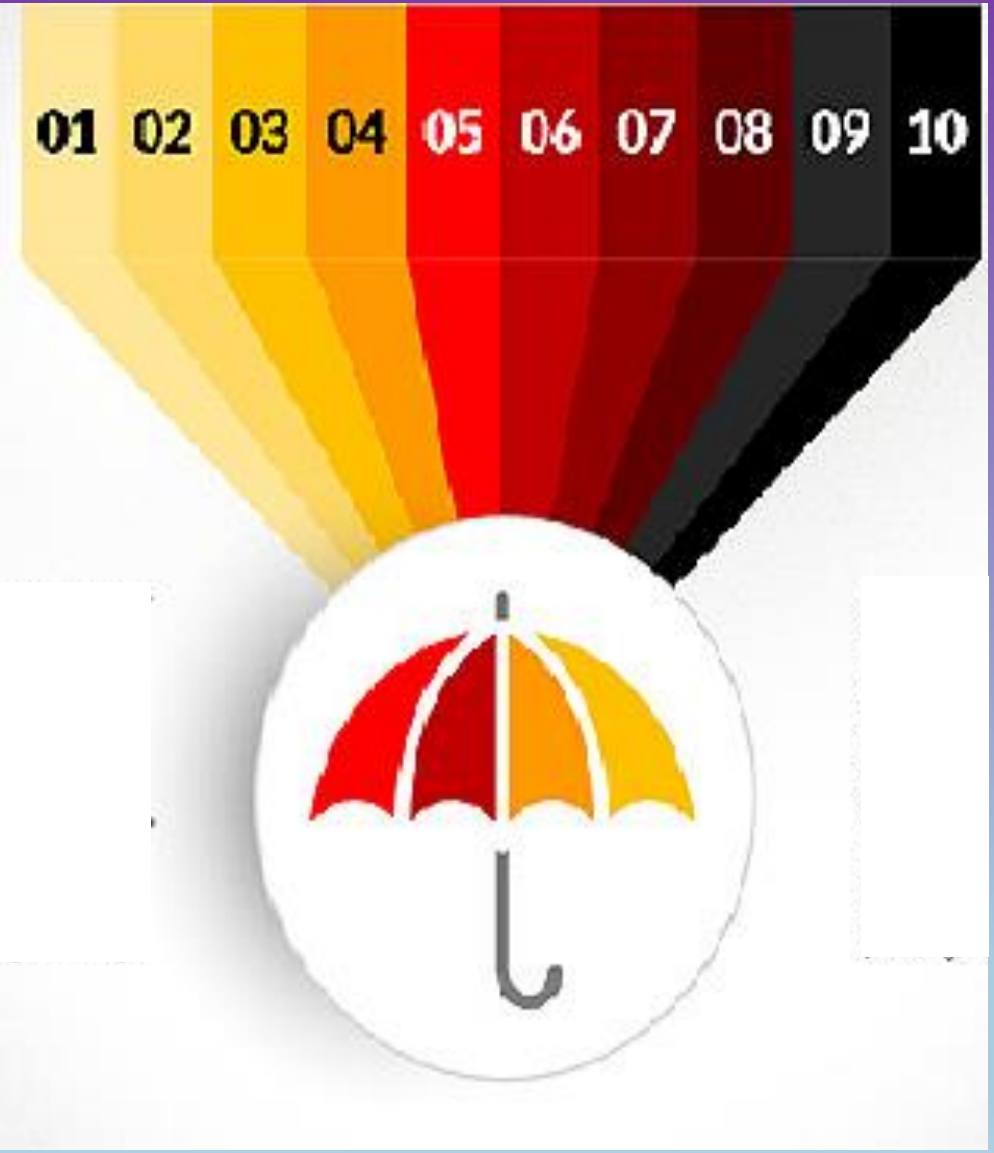
Center: $^{2}C_{1} = \frac{2!}{1!1!} = 2$

Forwards: $^{5}C_{2} = \frac{5!}{2!3!} = \frac{5*4}{2*1} = 10$

Guards: $^{4}C_{2} = \frac{4!}{2!2!} = \frac{4*3}{2*1} = 6$

$$^{2}C_{1} * {}^{5}C_{2} * {}^{4}C_{2}$$

Thus, the number of ways to select the starting line up is 2*10*6 = 120.



ORDERING OF PERMUTATIONS LEXICOGRAPHICAL ORDER

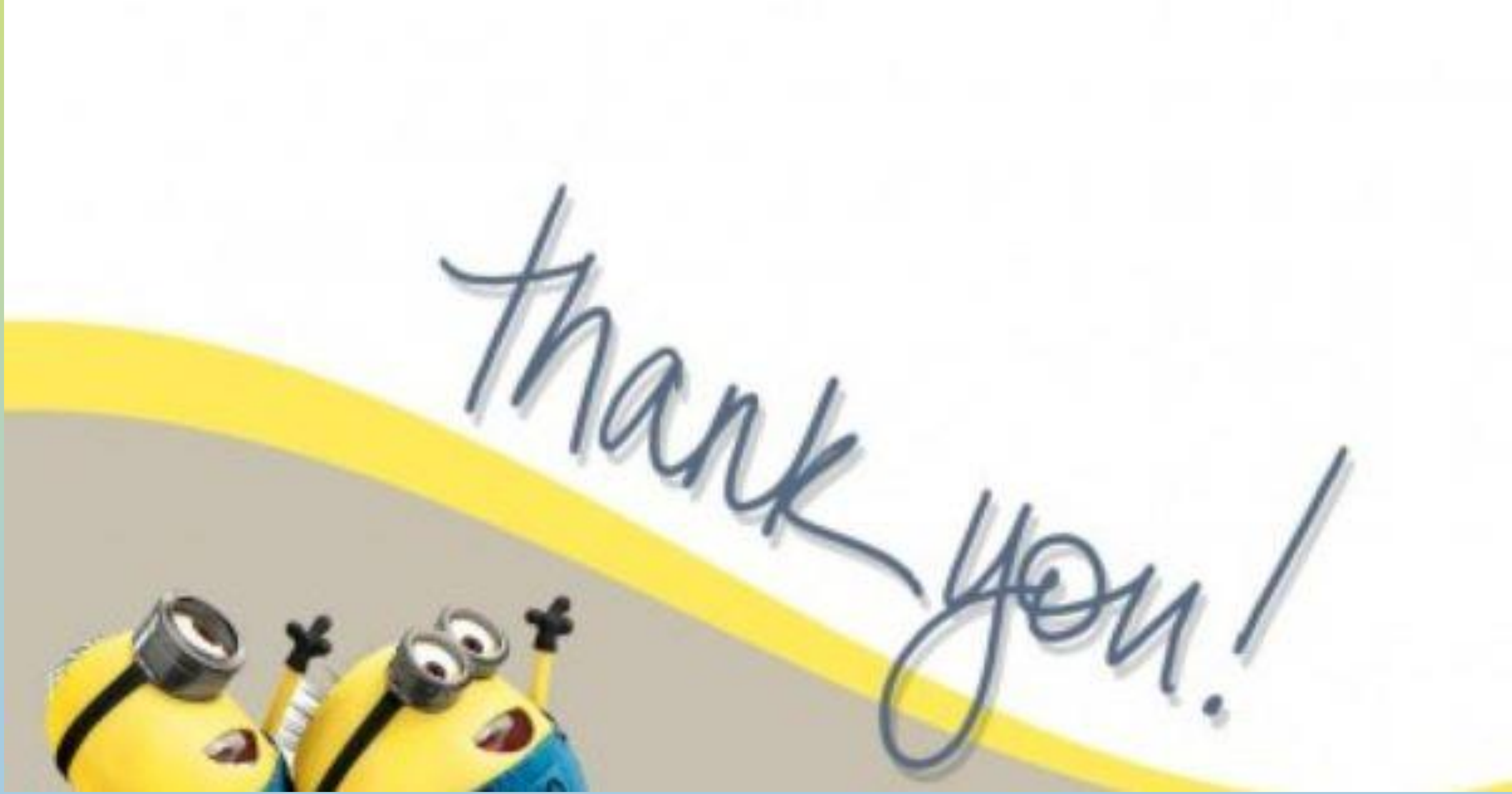
Generating Permutations: Any set with n elements can be placed in one-to-one correspondence with the set {1, 2, 3,…….n}. We can list the permutations of any set of n elements by generating the permutations of the n smallest positive integers and then replacing these integers with the corresponding elements. This is based on **lexicographic (or dictionary) ordering** of the set permutations of {1, 2, 3…….n}. In this ordering, the permutation $a_1, a_2, \ldots.. a_n$ precedes the permutations of $b_1, b_2, \ldots.. b_n$ if for some k, with $1 \leq k \leq n$, $a_1 = b_1$, $a_2 = b_2, \ldots \ldots a_{k-1} = b_{k-1}$, and $a_k < b_k$.

Example: Given a string, print all permutations of it in sorted order. For example, if the input string is “ABC”, then output should be “ABC, ACB, BAC, BCA, CAB, CBA”

Example *Generate the permutations of the integers* 1, 2, 3 *in lexicographic order.*

Solution Begin with 123. The next permutation is obtained by interchanging 3 and 2 to obtain 132. Next, because $3 > 2$ and $1 < 3$, permute the three integers in 132. Put the smaller of 3 and 2 in the first position, and then put 1 and 3 in increasing order in positions 2 and 3 to obtain 213. This is followed by 231, obtained by interchanging 1 and 3, because $1 < 3$. The next larger permutation has 3 in the first position, followed by 1 and 2 in increasing order, namely, 312. Finally, interchange 1 and 2 to obtain the last permutation, 321. ◀

Algorithm 1 displays the procedure for finding the next permutation in lexicographic order after a permutation that is not $n\ n-1\ n-2 \ldots 2\ 1$, which is the largest permutation.


thank you!