3rd October 2022 (Monday)

Scribed Notes – Lecture 21

Student ID :-

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COUNTING

Permutation: -

- Arrangements of elements from a set
- It's a Bijective function having same Domain and Co-Domain
- Linear/ordered arrangements of r elements among n.
- The notation for No. of ways to achieving this is ${}^{n}P_{r}$.
- No. of Permutations > No. of Combinations (More than)
- You can use the same elements again
- Shorthand:
    - [r] = {1,…,r} is an injective function.
    - [r]→[n] (Domain r to Co-Domain n).
- ${}^{n}p_{r} = (n!) / (n-r)!$

Combination: -

- Selection of r elements from a set among n.
- Due to the overcount in the permutation we have to remove the arrangements of r (i.e., r!) which is overcounted in the permutation
- Notation: $\binom{n}{r} = {}^{n}C_{r} = (n!) / (r)! * (n-r)!$
- $\binom{n}{r} = \binom{n}{n-r}$
- ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$

Combination: -

- The Binomial Theorem is the method of expanding an expression that has been raised to any finite power.
- Formula:

"sigma notation" simply indicates we'll be adding together a bunch of these guys

$$(x + y)^{n} = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^{k}$$

"n choose k" combinations formula we learned about earlier

$$
\begin{aligned}
(x+y)^0 &= 1,\\
(x+y)^1 &= x+y,\\
(x+y)^2 &= x^2+2xy+y^2,\\
(x+y)^3 &= x^3+3x^2y+3xy^2+y^3,\\
(x+y)^4 &= x^4+4x^3y+6x^2y^2+4xy^3+y^4,\\
(x+y)^5 &= x^5+5x^4y+10x^3y^2+10x^2y^3+5xy^4+y^5,\\
(x+y)^6 &= x^6+6x^5y+15x^4y^2+20x^3y^3+15x^2y^4+6xy^5+y^6,\\
(x+y)^7 &= x^7+7x^6y+21x^5y^2+35x^4y^3+35x^3y^4+21x^2y^5+7xy^6+y^7,\\
(x+y)^8 &= x^8+8x^7y+28x^6y^2+56x^5y^3+70x^4y^4+56x^3y^5+28x^2y^6+8xy^7+y^8.
\end{aligned}
$$