Mathematics Foundations (CBCA104)

Lecture-4

03/10/2022

Outline

➢ Power Set

➢ Universal Set

Power Set

Given the set S = {0, 1}. What are all the possible subsets of S?

➤ They are: ∅ (as it is a subset of all sets), {0}, {1}, and {0, 1}.

➤ **The power set of S (written as P(S)) is the set of all the subsets of S.**

P(S) = { ∅, {0}, {1}, {0,1} }.

➤ Note that |S| = 2 and |P(S)| = 4

Power Set

➤ Let T = {0, 1, 2}. The P(T) = { $\varnothing$, {0}, {1}, {2}, {0,1}, {0,2}, {1,2}, {0,1,2} }.

Note that |T| = 3 and |P(T)| = 8

➤ P($\varnothing$) = { $\varnothing$ }

Note that |$\varnothing$| = 0 and |P($\varnothing$)| = 1.

➤ <u>If a set has *n* elements, then the power set will have 2^n elements.</u>

➤ Note that $\varnothing \neq \{ \varnothing \}$.

The first is a set of zero elements. The second is a set of 1 element (that one element being the empty set).

Power Set

Which of the following is not element of power set of {2,3}?
I.   {2}
II.   {3}
III. {{2, 3}}
IV. {2, 3}

Answer: {{2, 3}}

If set A={1, 2, 3} then which of the following is incorrect?
I. $\phi \in A$
II. $\phi \in P(A)$
III. $\phi \subset A$
IV. $\phi \subset P(A)$

Answer: $\phi \in A$

Universal Set

➢ The set that contains all sets given in a context is called Universal Set.

(The set that contains everything.) The universal set is denoted by U.

➢ Example: If A={1, 2, 3}, B={2, 4, 5, 6} and C={1, 3, 5, 7}.

  Then the Universal Set is, U={1, 2, 3, 4, 5, 6, 7}.

Universal Set

➤ If A={x: x is a student of class BCA- B1, 2022},
   B={x: x is a student of class BCA- B2, 2022},
   C={x: x is a student of class BCA- B3, 2022},
   D={x: x is a student of class BCA- B4, 2022}.

Then Universal Set U is

   {x: x is a student of class BCA, 2022}.

Universal Set

➢ For the set of all integers (**Z**), the universal set can be set of rational numbers (**Q**) or set of real numbers (**R**).

➢ What universal set you would propose for each of the following?
(i) The set of right triangles
(ii) The set of the isosceles triangles

Set of triangles.

Exercise

Find the pairs of equal sets, if any, give reason:

A={0},   B={x: $x<5$ and $x>15$},

C={x: x-5=0},   D={x: $x^2 = 25$},

E={x: x is an integral positive solution of the equation $x^2 - 2x - 15 = 0$}.

Given sets are: A={0},   B = Empty Set,   C={5},

D={-5, 5},   E= {5}.

Thus Sets, C=E.