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CLASS:-

BS (SOFWARE ENGINEERING)

SECTION:-

A

SUBJECT:-

DISCRETE STRUCTURES

DATE:-

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<u>ASSIGNMENT NO:-2</u>

Q:1) What is Venn diagram? Explain in detail the Application of Venn diagram.

<u>ANSWER:-</u>

<u>VENN DIAGRAM:-</u>

A Venn diagram is a diagrammatic representation of ALL the possible relationships between different sets of a finite number of elements. Venn diagrams were conceived around 1880 by John Venn, an English logician, and philosopher. They are extensively used to teach Set Theory. A Venn diagram is also known as a Primary diagram, Set diagram or Logic diagram.

<u>OR</u>

A Venn diagram is an illustration that uses circles to show the relationships among things or finite groups of things. Circles that overlap have a commonality while circles that do not overlap do not share those traits.

Venn diagrams help to visually represent the similarities and differences between two concepts. They have long been recognized for their usefulness as educational tools. Since the mid-20th century, Venn diagrams have been used as part of the introductory logic curriculum and in elementary-level educational plans around the world.

UNDERSTANDING THE VENN DIAGRAM:-

The English logician John Venn popularized the diagram in the 1880s. He called them Eulerian circles after the Swiss mathematician Leonard Euler, who created similar diagrams in the 1700s.

The term Venn diagram did not appear until 1918 when Clarence Lewis, an American academic philosopher and the eventual founder of conceptual pragmatism, referred to the circular depiction as the Venn diagram in his book ***A Survey of Symbolic Logic.***

APPLICATIONS FOR VENN DIAGRAM:-

Venn diagrams are used to depict how items relate to each other against an overall backdrop, universe, data set, or environment. A Venn diagram could be used, for example, to compare two companies within the same industry by illustrating the products both companies offer (where circles overlap) and the products that are exclusive to each company (outer circles).

- *Venn diagrams are, at a basic level, simple pictorial representations of the relationship that exists between two sets of things. However, they can be much more complex. Still, the streamlined purpose of the Venn diagram to illustrate concepts and groups has led to their popularized use in many fields, including statistics, linguistics, logic, education, computer science, and business.*

De Morgan's Laws:

- *For any sets A and B, then*

$$(A \cup B)' = A' \cap B'$$

The compliment of the union is the intersection of each compliment.

$$(A \cap B)' = A' \cup B'$$

The compliment of the intersection is the union of each compliment.

Solving the Cardinal Number Problem:

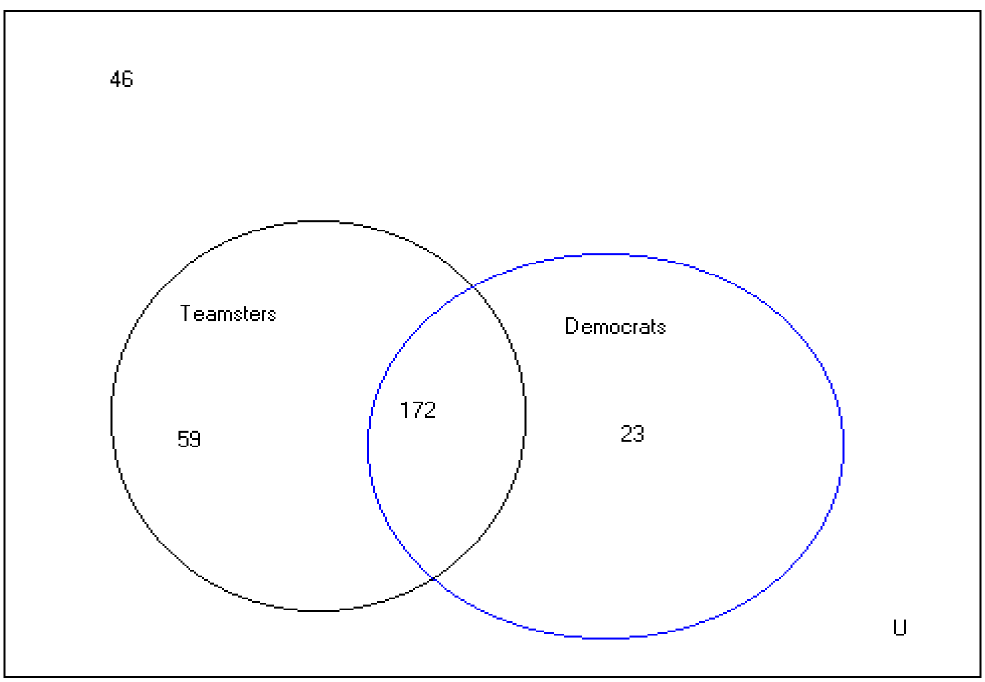
- *Define a set for each category in the universal set.*
- *Draw a Venn diagram with as many overlapping circles as the number of sets you have defined.*
- *Write down all the given cardinal numbers corresponding to various given sets.*
- *Starting with the innermost overlap, fill in each region of the Venn diagram with its cardinal number.*

Example 1:

- *A survey of 300 workers yielded the following information: 231 belonged to the Teamsters Union, and 195 were Democrats. If 172 of the Teamsters were Democrats, how many workers were in the following situations?*

A. *Belonged to the Teamsters or were Democrats*
B. *Belonged to the Teamsters but were not Democrats*
C. *Were Democrats but did not belong to the Teamsters*
D. *Neither belonged to the Teamsters nor were Democrats.*

Venn Diagram for example 1:



Explanation:

- *Let us define T = The event that a worker belongs to the teamsters, and D = the event that a worker is a Democrat. Note that n(U) = 300.*
- *We were given the fact that 172 workers were both in the Teamsters and a Democrat, that is* $n(T \cap D)=172$
- *We are given that* $n(T)=231$ *and* $n(D)=195$.
- *Thus* $n(T \cup D) = n(T) + n(D) - n(T \cap D)$

$$n(T \cup D) = 231 + 195 - 172 = 254.$$

- *Those who are only Democrats and do not belong to the Teamsters are* $n(D) - n(T \cap D) = 195 - 172 = 23$.
- *Those who are only Teamsters but not Democrats are* $n(T) - n(T \cap D) = 231 - 172 = 59$.
- *Those who are neither Teamster or Democrat fall outside of the circles. Use the complimentary law* $n(T \cup D) + n((T \cup D)') = n(U)$.
- $n((T \cup D)') = n(U) - n(T \cup D) = 300 - 254 = 46$.

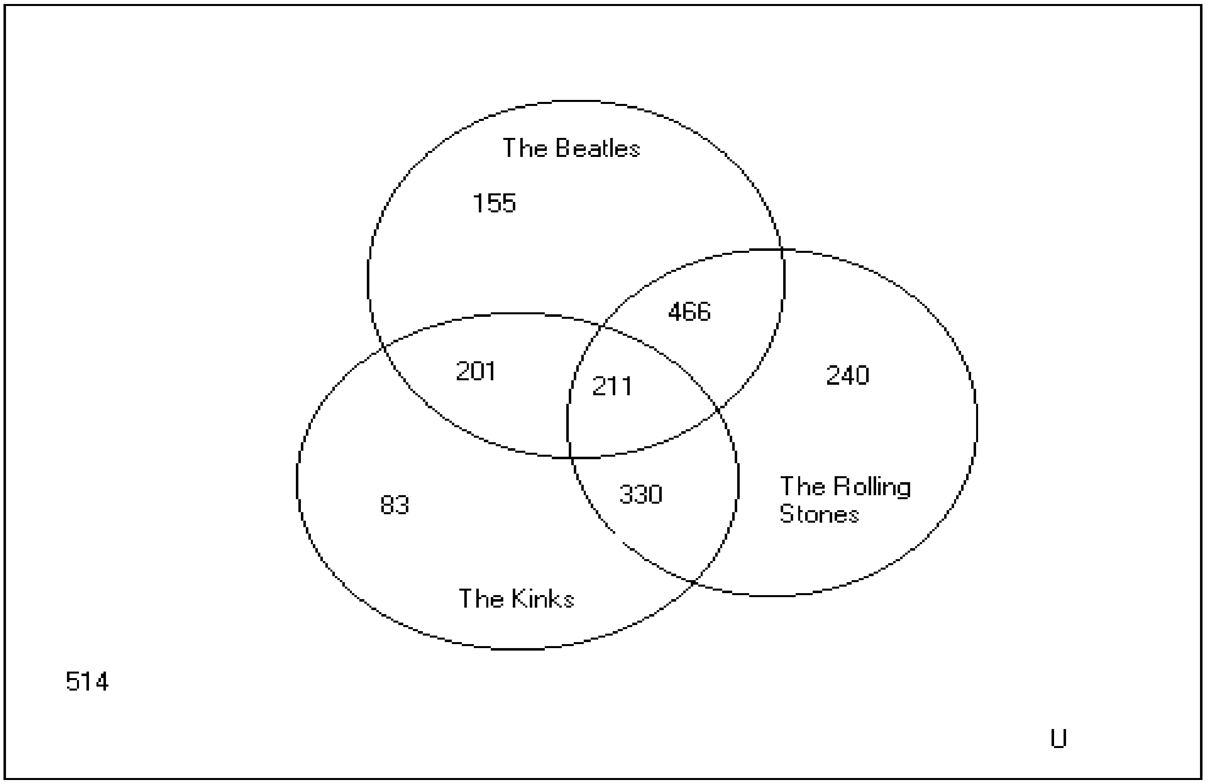
Example 2:

- *Way back in 1965, The Beatles, The Kinks, and The Rolling Stones toured the USA. A large group of teenagers were surveyed and the following information was obtained: 825 saw The Kinks,* *1033 saw The Beatles, 1247 saw The Rolling Stones, 211 saw all three, 514 saw none, 240 saw only The Rolling Stones, 677 saw The Rolling Stones and The Beatles, and 201 saw The Beatles and The Kinks but not The Rolling Stones.*

A. What percent of the teenagers saw at least one band?

B. What percent of the teenagers saw exactly one band?

Venn Diagram Example 2:



Explanation:

- *Begin labeling the diagram with the innermost overlap. 211 saw all three.*
- *Note also that the region outside of the circle contains 514. These are teens who saw no band.*
- *Continue using the given info: 240 saw only the Rolling Stones.*
- *201 saw The Beatles and The Kinks but not The Rolling Stones.*
- *677 saw The Beatles and The Rolling Stones. Now that region already has 211 people in there. Take*

677-211 and that will give 466 people who saw The Beatles and the Rolling Stones but not The Kinks.

- *Now we can find the people who only saw The Beatles.*
- *Take 1033 and subtract (201+211+466). This gives 155 people who only saw The Beatles.*
- *To find the number of people who saw The Rolling Stones and The Kinks but not the Beatles, take 1247 – (211+466+240)=330.*
- *To find the number of people who only saw The Kinks 825 – (211+ 201+33) = 83.*
- *The total number of people surveyed is 83+201+211+330+240+446+155+514=2200.*
- *Now answer question A: The people who saw at least one band is (2200-514)/2200=76.6%*
- *Question B: The people who saw only one band is (83+155+240)/2200=21.7%.*

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Q: 2) What is Union? Draw Membership table for union using different examples

<u>ANSWER:</u>

UNION:-

In mathematics, the union (denoted by ∪) of a collection of sets is the set of all elements in the collection. It is one of the fundamental operations through which sets can be combined and related to each other.

UNION OF TWO SETS:-

The union of two sets A and B is the set of elements which are in A, in B, or in both A and B. In symbols,

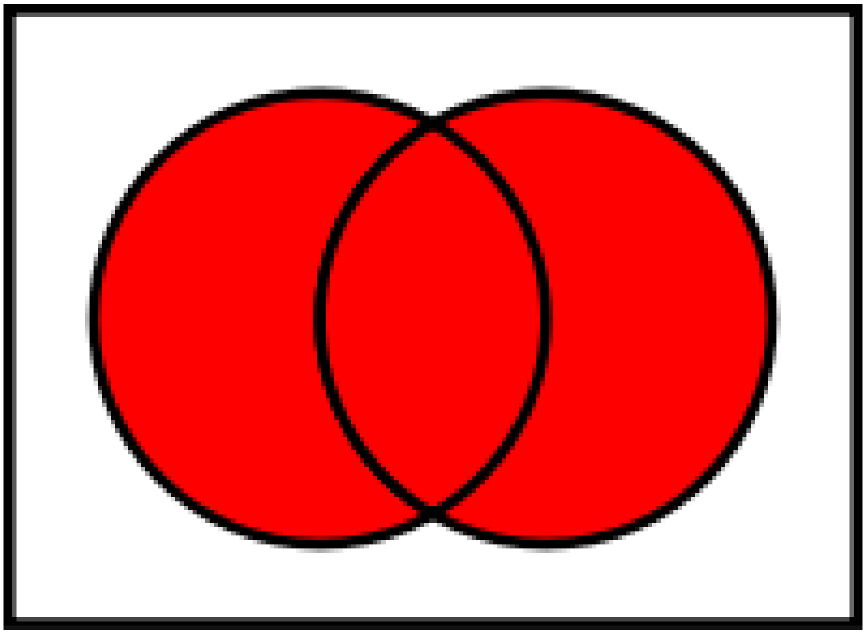
For example, if A = {1, 3, 5, 7} and B = {1, 2, 4, 6, 7} then A ∪ B = {1, 2, 3, 4, 5, 6, 7}. A more elaborate example (involving two infinite sets) is:

A = {x is an even integer larger than 1}
B = {x is an odd integer larger than 1}

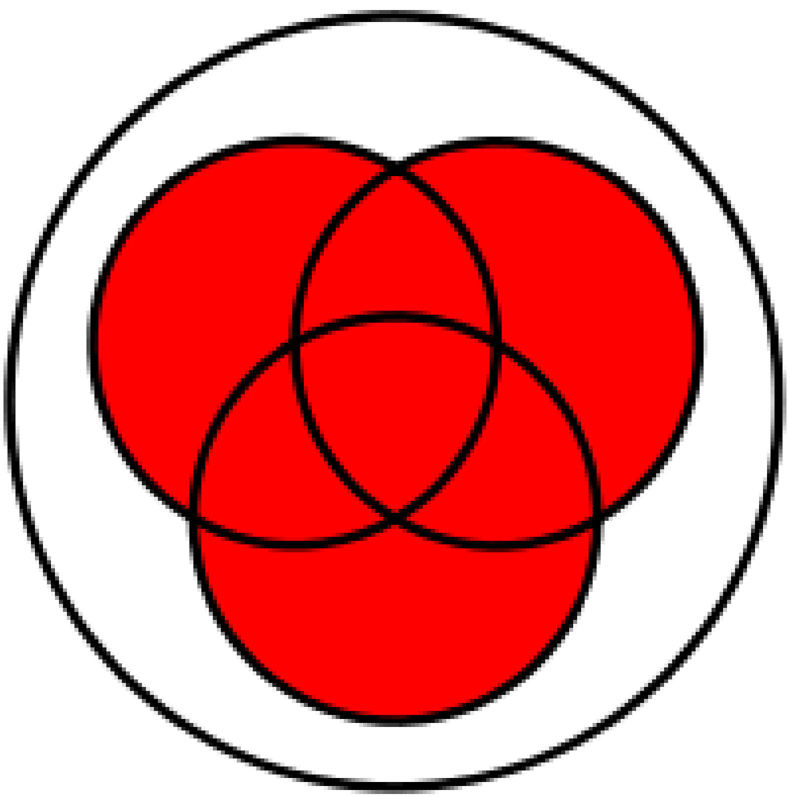
As another example, the number 9 is not contained in the union of the set of prime numbers {2, 3, 5, 7, 11, ...} and the set of even numbers {2, 4, 6, 8, 10, ...}, because 9 is neither prime nor even.

Sets cannot have duplicate elements, so the union of the sets {1, 2, 3} and {2, 3, 4} is {1, 2, 3, 4}. Multiple occurrences of identical elements have no effect on the cardinality of a set or its contents.

Following is the diagram of union .



The above diagram shows union of two(2) sets. i.e $A \cup B$



The above diagram shows union of two(3) sets. i.e $A \cup B \cup C$

MEMBERSHIP TABLE FOR UNION:-

The Membership table for the union of sets A and B is given below. The truth table for disjunction of two statements P and Q is given below.
In the membership table of Union replace, 1 by T and 0 by F then the table is same as of disjunction.
So membership table for Union is similar to the truth table for disjunction (V).

FIRST EXAMPLE:

A	*B*	*A ∪ B*
1	*1*	*1*
1	*0*	*1*
0	*1*	*1*
0	*0*	*0*

TRUTH TABE

P	*Q*	*P V Q*
T	*T*	*T*
T	*F*	*T*
F	*T*	*T*
F	*F*	*F*

SECOND EXAMPLE:

C	*D*	*C ∪ D*
1	*1*	*1*
1	*1*	*1*
1	*0*	*1*
1	*0*	*1*
0	*1*	*1*
0	*1*	*1*
0	*0*	*0*
0	*0*	*0*

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Q: 3) What is Intersection? Draw Membership table for intersection using different examples?

ANSWER:-

INTERSECTION:-

In mathematics, the intersection of two sets A and B, denoted by A ∩ B, is the set containing all elements of A that also belong to B (or equivalently, all elements of B that also belong to A).

INTERSECTION OF TWO SETS OR MORE SETS:-

The intersection of two sets A and B, denoted by $A \cap B$, is the set of all objects that are members of both the sets A and B. In symbols,

That is, x is an element of the intersection $A \cap B$ if and only if x is both an element of A and an element of B.

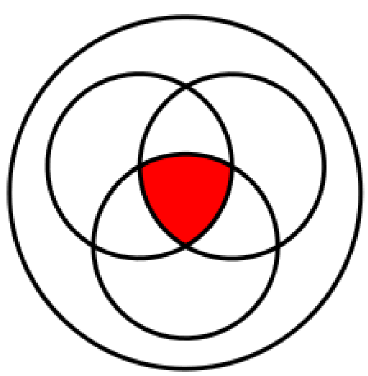
For example:

- *The intersection of the sets {1, 2, 3} and {2, 3, 4} is {2, 3}.*
- *The number 9 is not in the intersection of the set of prime numbers {2, 3, 5, 7, 11, ...} and the set of odd numbers {1, 3, 5, 7, 9, 11, ...}, because 9 is not prime.*

Intersection is an associative operation; that is, for any sets A, B, and C, one has $A \cap (B \cap C) = (A \cap B) \cap C$. Intersection is also commutative; for any A and B, one has $A \cap B = B \cap A$. It thus makes sense to talk about intersections of multiple sets. The intersection of A, B, C, and D, for example, is unambiguously written $A \cap B \cap C \cap D$.

Inside a universe U one may define the complement A^c of A to be the set of all elements of U not in A. Now the intersection of A and B may be written as the complement of the union of their complements, derived easily from De Morgan's laws:
$A \cap B = (A^c \cup B^c)^c$

Following diagram shows the intersection of three sets.i.e $\boldsymbol{A \cap B \cap C}$



MEMBERSHIP TABLE FOR INTERSCTION:-

The Membership table for intersection of sets A and B is given below.
The truth table for conjunction of two statements P and Q is given below
In the membership table of Intersection, replace 1 by T and 0 by F then the table is same as of conjunction.
So membership table for Intersection is similar to the truth table for conjunction (∧).

FIRST EXAMPLE:

A	***B***	***A ∩ B***
1	*1*	*1*
1	*0*	*0*
0	*1*	*0*
0	*0*	*0*

TRUTH TABE

P	***Q***	***P ∧ Q***
T	*T*	*T*
T	*F*	*F*
F	*T*	*F*
F	*F*	*F*

SECOND EXAMPLE:-

C	*D*	*C ∩ D*
1	1	1
1	1	1
1	0	0
1	0	0
0	1	0
0	1	0
0	0	0
0	0	0

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Q:4) What is Difference? Draw Membership table for Set difference using different examples.

ANSWER:-

DIFFERENCE:-

The difference of set B from set A, denoted by A-B, is the set of all the elements of set A that are not in set B. In mathematical term,
A-B = {x: x∈A and x∉B}

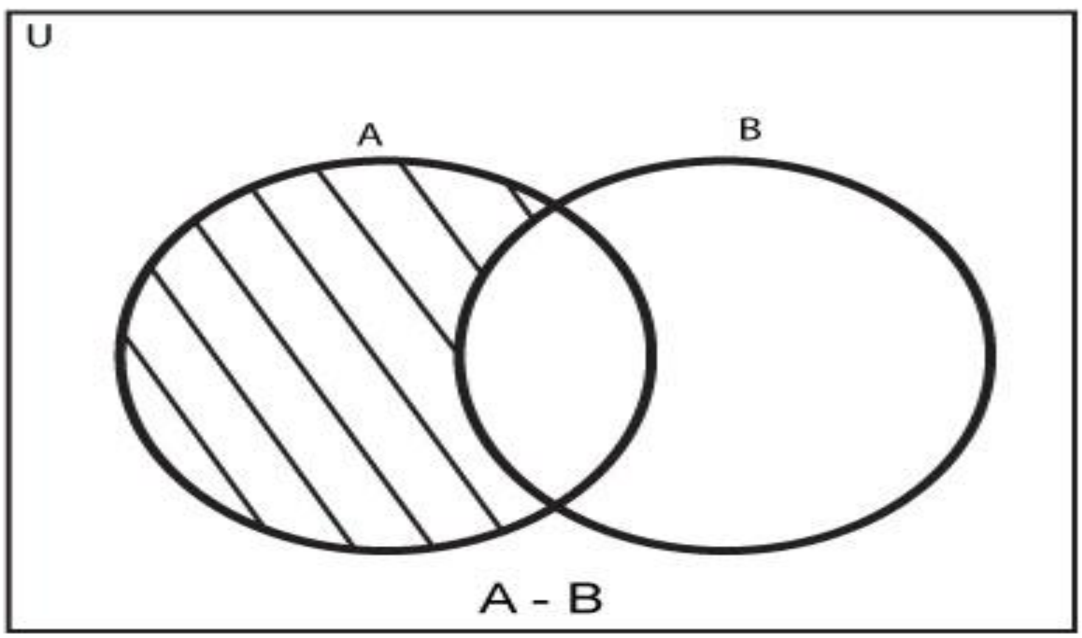


Fig. Difference of sets (A-B)

If (A∩B) is the intersection between two sets A and B then,

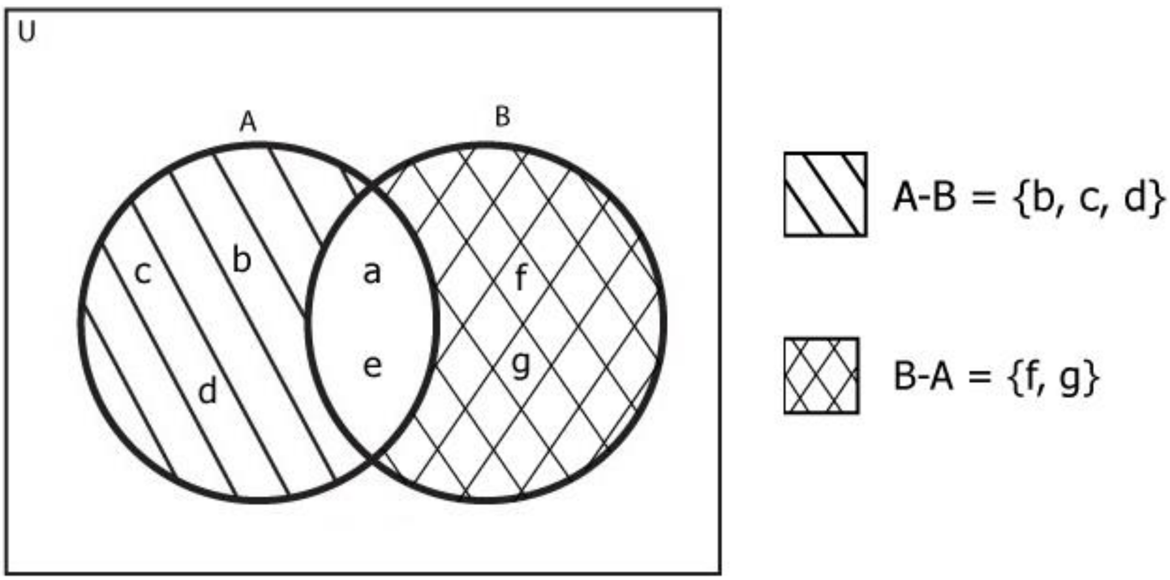
A-B = A – (A∩B)

DIFFERENCE OF SETS EXAMPLES:-

EXAMPLE NO 1:-

If A = { a, b, c, d, e } and B = { a, e, f, g}, find A-B and B-A.
The elements in only A are b, c, d and elements in only B are f, g.
Thus,

A-B = {b,c,d}
And B-A = {f,g}



Notice that, A-B may not be equal to B-A.

EXAMPLE NO 2:-

If A = { 1, 2, 4, 6, 8} and A-B = {1, 6, 8}, Find A∩B.
The intersection of A and B, (A∩B) is the set of all elements common in both A and B. Thus,

(A∩B) = A - (A-B)

Or , (A∩B) = {2,4}

IDENTITIES INVOLVING DIFFERENCE OF SET:

1. *If set A and B are equal then,* $A\text{-}B = A\text{-}A = \phi$ **(empty set)**
2. *When an empty set is subtracted from a set (suppose set A) then, the result is that set itself, i.e,* $A - \phi = A$.
3. *When a set is subtracted from an empty set then, the result is an empty set, i.e,* $\phi - A = \phi$.
4. *When a superset is subtracted from a subset, then result is an empty set, i.e,* $A - B = \phi$ *if* $A \subset B$

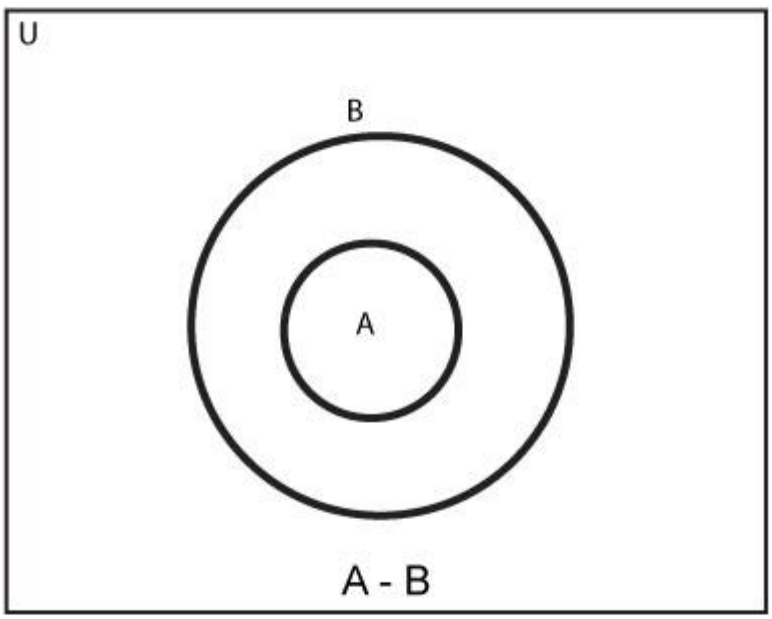
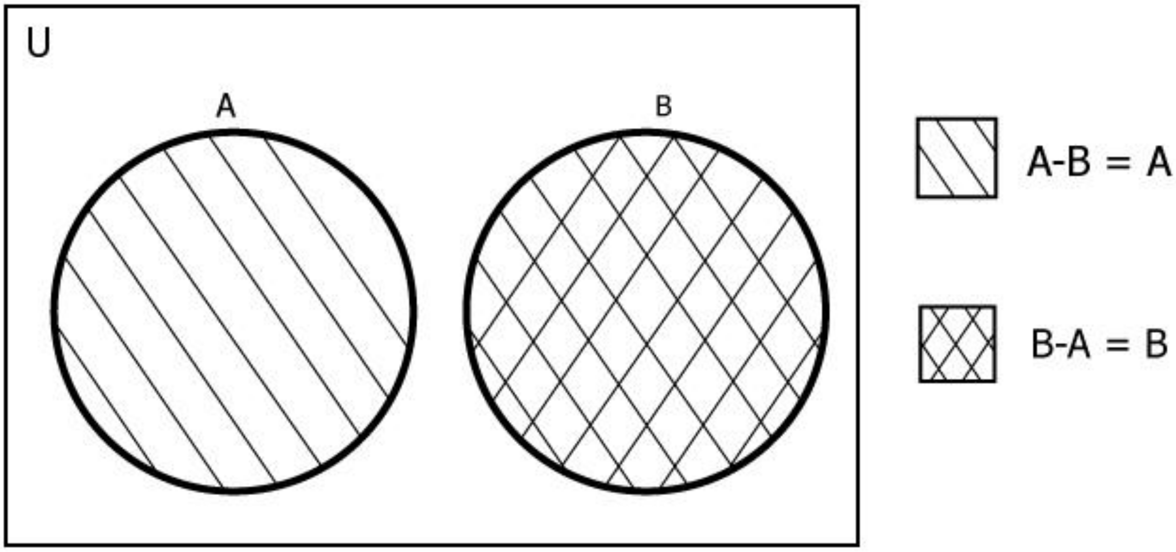


Fig. Difference of superset from subset

5. *If A and B are disjoint sets then,* $A\text{-}B = A$ *and* $B\text{-}A = B$



MEMBERSHIP TABLE FOR SET DIFFERENCE:-

The Membership table for the difference of sets A and B is given below.
The truth table for negation of implication of two statements P and Q is given below.
In the membership table of difference, replace 1 by T and 0 by F then the table is same as of negation of implication.
So membership table for difference is similar to the truth table for negation of implication.

EXAMPLE NO: 1 *TRUTH TABLE*

A	*B*	*A – B*
1	*1*	*0*
1	*0*	*1*
0	*1*	*0*
0	*0*	*0*

P	*Q*	*P ∧ Q*
T	*T*	*T*
T	*F*	*F*
F	*T*	*F*
F	*F*	*F*

EXAMPLE NO: 2

C	*D*	*C - D*
1	*1*	*0*
1	*1*	*0*
1	*0*	*1*
1	*0*	*1*
0	*1*	*0*
0	*1*	*0*
0	*0*	*0*
0	*0*	*0*

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