Worked Examples

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Module 3: Set Theory

Session 7: Introduction to Sets

1. Use the language of sets to describe and define sets

   Describe the following sets in words:
   (a) A = { 2, 3 5, 7}
   (b) { a, e, i, o, u}

   (a) A = { 2, 3 5, 7} is the set of prime numbers from 1 to 10.
   (b) { a, e, i, o, u}

2. Identify different types of sets including empty and infinite sets:

   State the type of set for each of the following:

   (i) E = {even numbers}
   (ii) B = { men over ten feet tall}
   (iii) V = {1,2,3,4,5…..,1000}

   (i) E = {even numbers} – infinite set
   (ii) B = { men over ten feet tall} - empty set
   (iii) V = {1,2,3,4,5…..,1000} - finite set

3. Identify and distinguish between sets that are equivalent and sets which are equal.

   (a) Are the sets C = { 1, 3, 2} and D = { 1,1,2,3,3 } equal or equivalent? Give a reason for your answer.
   (b) Are the sets M = { a, 4, 5} and D = { 1,1,2,3,3 } equal or equivalent? Give a reason for your answer.

(a) C = { 1, 3, 2} and D = { 1,1,2,3,3 } are equal because they have IDENTICAL elements, and the SAME NUMBER of elements. Repeated elements are counted ONCE
(b) M = { a, 4, 5} and D = { 1,1,2,3,3 } are equivalent because they have the same NUMBER of elements.

4. Identify the cardinal number of a set.

   State the cardinality or number of elements in the set D = { 1,1,2,3,3 }.

   n(D) = 3. Repeated elements are counted once.

5. Identify and construct subsets of a given set.

   Write down all the subsets of {a,b}.

   Subsets: { }, { a } , { b } , {a,b} .

6. Calculate the number of subsets of a set of n elements

   How many subsets can be formed from G = {a,e,i ,o,u}?

   Number of subsets = 2^5 = 32.

7. Determine the complement of a given set, given the universal set

   Given the Universal set U = {1,2,3,4, ……, 10} and B = { prime numbers}, state B^c, the complement of B.

   Now, B = { 2,3,5,7 }. Therefore, B^c = { 1,4,6,8,9,10}.

8. Determine and count the elements in the intersection and union of two sets.

   Given the Fig. 1 below.

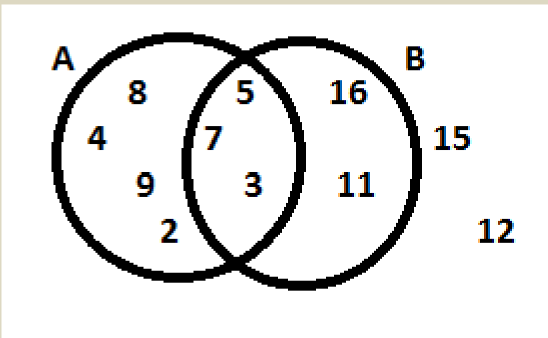

Fig. 1

State A U B (ii) n(A ∩ B)

A U B = {2, 3, 4, 5, 7, 8, 9, 11, 12, 15, 16}

Since A ∩ B = { 3,5, 7}, then n (A ∩ B) = 3.

9. Construct and use Venn diagrams to show subsets, complements and the intersection and union of sets.

Given the sets W and Y in Fig. 2 below

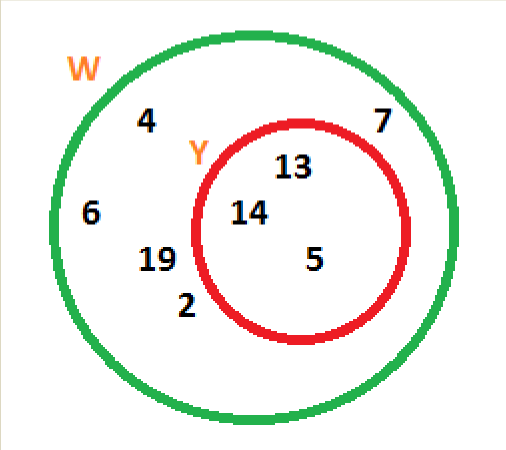

Fig. 2

(i) Show that Y is a subset of W.
(ii) State Y^c, the complement of C.
(iii) Write down Y U W
(iv) Determine n(Y ∩ W)

(i) Now, W = {2, 4, 5, 6, 7, 13, 14, 19} and Y = { 5, 13, 14}.

Since the elements in Y are also contained in W, then Y is a subset of W.

(ii) From the diagram, Y^c = { 2, 4 6, 7, 19}.

(iii) Since Y is a subset of W, Y U W = W = {2, 4, 5, 6, 7, 13, 14, 19}

(iv) Since Y is a subset of W,

Y ∩ W = Y

Therefore, n(Y ∩ W) = n (Y) = 3

10. Determine the number of elements in named subsets of two intersecting sets, given the number of elements in some of the other subsets

The diagram below shows the number of subsets for the regions in set M and N.

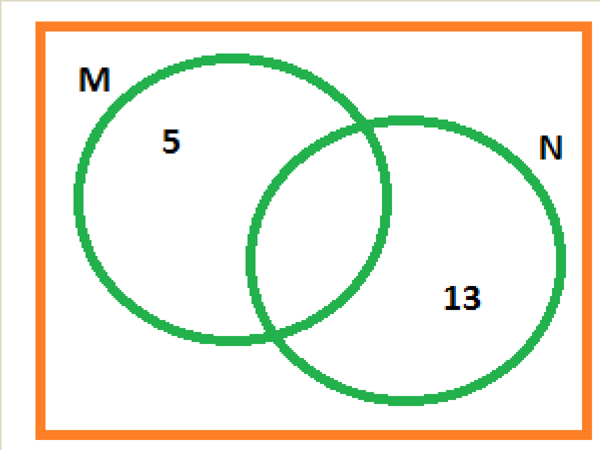

Fig. 3

If n (M) = 23, find (a) n (M ∩ N) (b) n (M U N)

(a) Since n (M) = 23, then n (M ∩ N) = 23 – 5 = 18

(b) n (M U N) = 5 + 18 + 13 = 36.

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