1 Set Theory

1. The Universal Set $\mathcal{U}$
2. Union
3. Intersection
4. Set Difference
5. Relative Difference

Question 2B 2010 Zone A

- Let A and B be subsets of the a universal set U.
- Use membership tables to prove that $(A \cup B')' = A' \cap B$
- Shade the regions corresponding to this set on a Venn Diagram

A	B	B′	A $\cup B'$	(A $\cup B'$)′
0	0	1	1	0
0	1	0	0	1
1	0	1	1	0
1	1	0	1	0

A	B	A′	A′ $\cap B$
0	0	1	0
0	1	1	1
1	0	0	0
1	1	0	0

Given the universal set U and subsets A and B, list the set $(A \cup B')'$

- $U = \{1, 2, \ldots, 8, 9\}$
- $A = \{2, 4, 6, 8\}$
- $B = \{4, 5, 6, 7\}$
- $B' = \{1, 2, 3, 8, 9\}$
- $A \cup B' = \{1, 2, 3, 4, 6, 8, 9\}$
- $(A \cup B')' = \{5, 7\}$

2010 Zone B Q 1
5n+1 Rules of Inclusion method
$A = \{5n + 1 : n \in Z\}$

Floating Point Notation

(Demonstration on white board)

2011 Zone A question 1d

Showing your workings, express the repeating decimal 0.012012012012... as a rational number in its simplest form.

- x = 0.012012012012...
- 10x = 0.12012012012... (not particularly useful)
- 100x = 1.2012012012... (not particularly useful either)
- 1000x= 12.012012012... (very useful)
- 999x = 12
- x= 12/999 = 4/333 (Answer!)

2008 Zone A question2a

$B = \{3n - 1 : n \in Z^+\}$ Describe the set B using the listing method

- Let $n = 1$. Consequently $3(1) - 1 = 2$
- Let $n = 2$. Likewise $3(2) - 1 = 5$
- Let $n = 3$. $3(3) - 1 = 8$
- The repeated differences are 3. The next few values are 11, 14 and 17
- So by the listing method $B = \{2, 5, 8, 11, 14, 17, \ldots\}$

$A = \{3, 5, 7, 9, ldots\}$ Describe the set A using the rules of inclusion method

- The repeated differences are 2.
- We can say the rule has the form $2n + k$
- For the first value n=1. Therefore $2 + k = 3$
- Checking this , for the second value , n=2. Therefore $4 + k = 5$
- Clearly k = 1.
- $A = \{2n + 1 : n \in Z^+\}$
- So by the listing method $B = \{2, 5, 8, 11, 14, 17, \ldots\}$

2 Set Theory

1. The Universal Set $\mathcal{U}$
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3. Intersection
4. Set Difference
5. Relative Difference

Dice Rolls

Consider rolls of a die. What is the universal set?

$$\mathcal{U} = \{1, 2, 3, 4, 5, 6\}$$

Worked Example

Suppose that the Universal Set $\mathcal{U}$ is the set of integers from 1 to 9.

$$\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\},$$

and that the set $\mathcal{A}$ contains the prime numbers between 1 to 9 inclusive.

$$\mathcal{A} = \{1, 2, 3, 5, 7\},$$

and that the set $\mathcal{B}$ contains the even numbers between 1 to 9 inclusive.

$$\mathcal{B} = \{2, 4, 6, 8\}.$$

Complements

- The Complements of A and B are the elements of the universal set not contained in A and B.
- The complements are denoted $\mathcal{A}'$ and $\mathcal{B}'$

$$\mathcal{A}' = \{4, 6, 8, 9\},$$
$$\mathcal{B}' = \{1, 3, 5, 7, 9\},$$

Intersection

- Intersection of two sets describes the elements that are members of both the specified Sets
- The intersection is denoted $\mathcal{A} \cap \mathcal{B}$

$$\mathcal{A} \cap \mathcal{B} = \{2\}$$

- only one element is a member of both A and B.

Set Difference

- The Set Difference of A with regard to B are list of elements of A not contained by B.
- The complements are denoted $\mathcal{A} - \mathcal{B}$ and $\mathcal{B} - \mathcal{A}$

$$\mathcal{A} - \mathcal{B} = \{1, 3, 5, 7\},$$

$$\mathcal{B} - \mathcal{A} = \{4, 6, 8\},$$

symbols

$\varnothing$, $\forall$, $\in$, $\notin$, $\cup$

Prepositional Logic

- $p \wedge q$
- $p \vee q$
- $p \rightarrow q$

3 Sequence and Series and Proof by Induction

$$\sum(n^2)$$

Relative Difference

- $A \otimes B$

Power Sets

- Consider the set A where $A = \{w, x, y, z\}$
- There are 4 elements in set A.
- The power set of A contains 16 element data sets.
- $$\mathcal{P}(A) = \{\{x\}, \{y\}\}$$
- (i.e. 1 null set, 4 single element sets, 6 two -elemnts sets, 4 three lement set and one 4- element set.)

- $p \to q$ p implies q
- $p \lg q$

Relative Difference

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