**Discrete Mathematics**Week 1 of Discrete Mathematics Subject, President University.

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1. **INTRODUCTION**  
   General Math =  
     
   Formula = if y = x.  
   This is called general math, it is continuous like you see (continuous line). For example If x = 5, the y value will be 5 as well, since the vertical line, if stretched are intersected with the vertical line, logically you can put any x point and you will still get the y point regardless, even if you put 2,5 or 5,8. You will still get the y values, Continuous Math or General Math uses **Real Numbers.**  
   Discontinued or so called Discrete is for example, where the line become a Dotted Lines instead of a Vertical Line, it is not continued anymore, now you can’t just put any x, since it will be false if the vertical line stretched did not hit the Dotted Line. For example say the line is aligned with every integer value (1,2,3,4,5,…), you can’t put 1,5 because it will be automatically false. Discrete Mathematic also uses **Integer Numbers** and focus on **Logic** therefore alter our **Decision**
2. **PROPORTIONAL LOGICS**The simplest logic.  
   Definition : is a **Statement** that is either **true** or **false**  
   *for Example :*  
    **1**. President University Is located in Cikarang :  
    Output : True (Because President University is in fact, located in Cikarang).  
    **2**. -5 + 2 = 8  
    Output : False (Because -5 + 2 is -3)  
    **3**. Is it raining today?  
    Output : Either True or False, assuming that we are inside a isolated building, we don’t know whether its true or not.  
   **It has to be a 1 statement Output and Can’t be both.** (Not yet).  
    Basically :  
    Is it Proposition? (if yes) > 1 Output or no? (if yes) > Statement (True or False).  
    Special : Either True or False, produces chance of having Both.  
   **Binary Digits:**for example, a number of 1750, separated into a lot of things, first there are 4 units (11725304), which consists of tenth (50), hundreds (700), and thousand (1000).  
   Bit is for Binary Digit, 2n where n is the Digit.  
   **For example Binary Number**  
   5 = b3b2b1b0 (Binary Digit consists of 4 Bit)  
   *how it works : each b (Bit) from 0 to 4, consist of bn, which starts with 1 then 2, then 4, then 8, then 16, then 32, then 64 (multiplication of 2) so logically speaking, b0 becomes 1, b1 becomes 2, b3 becomes 4 and b4 becomes 8.*  
   Now is 5 greater than b­3 (8)?, if Yes > 5 – 8, but it’s not now it stays 5  
   Is 4 > b3(4)?, if Yes > 5 – 4, now it becomes 1.  
   Is 1 > b2(2)?, if Yes > 1 – 2, but it’s not so it stays 1.  
   Is 1 >= b1(1)?, if Yes > 1 – 1, then it makes 0.  
   **Each time the number is greater than b, it becomes 1, each time it’s not, it becomes 0** (Answer : 0101).  
   Another example is that 13 = b3b2b1b0 (8,4,2,1)  
   Which makes it 1101.
3. **Logical Connectives**There are multiple Logical Connectives, which consists of :
4. Negation
5. Disjunction
6. Exclusive Or
7. Implication
8. Biconditional

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| --- | --- | --- |
| **Name** | **Syntax** | **Symbol** |
| Negation | “It is not the case of …” Simplier : **not** for example : 1. It rains outside. It **does not** rains outside | 1. ┐A 2. Ā 3. A’ |
| Conjunction | **AND** | 1. ꓥ 2. ∙ |
| Disjunction | **OR** | 1. ꓦ 2. + |
| Exclusive Or | **Exclusive Or XOR** | 1. ⊕ |
| Implication | There are 14 different Syntax of Implication, 3 of them are :   1. If … then … 2. If …, … 3. q if p | 1. -> |
| Biconditional | … if and only if … Or so called **iff** | 1. < --- > |

1. **The Logical Problems**  
   ***x + 5 = 3***is not a propositions, **UNTIL** you put in a function to it.  
   for example
2. *f(x) = x+5 = 3*if *f(3) = x+5 = 3* it becomes a propositions. (Because you know the output of the statement whether it is true or not).

another example will be

1. There are other life forms on the Planet  
   **First** we must agree that *other life forms* means Aliens, so we have something to work with, and we can put in a Function instantly after that.  
   *f(p) = There are other life forms on the planet* ***P .****f(Earth) = There are other life forms on the planet Earth*which then becomes a propositions because we know it is a statement with only 1 output value, which is **False**
2. **Logical Connectives Explanation  
   Negation**Definition : Let **p** be a proposition. The statement “It is not the case that *p.*” is another proposition, called the **negation of p. The negation of p is denoted by ┐p** and read as “not p.”  
   Example :
3. 5 + 2 != 8
4. 10 is not a prime number.
5. It is not the case that buses stop running at 9:00 PM.

**Conjunction**Definition : Conjunction means Anding of two statements. If p,q are two statements, then “p and q: is a compound statement, denoted by **p ꓥ q** and referred as **the conjunction of p and q**. **The conjunction of p and q is true only when both p and q are true.** Otherwise, it is false.  
Example :

1. Pitt is located in the Oakland section of Pittsburgh and 5+2 = 8
2. It is raining today and 2 is a prime number.
3. 2 is a prime number and 5+2 != 8
4. 13 is a perfect square and 9 is a prime

**Disjunction**Definition : Disjunction means oring of two statements. If p,q are two statements, then “p or q” is a compound statement, denoted by **p V q** and referred to as the disjunction of p and q. The disjunction of p and q is true whenever at least one of the two statements is true, and it is false only when both p and q are false.  
Example :

1. Pitt is located in the Oakland section of Pittsburgh **or** 5+2 = 8
2. It is raining today (assuming) **or** 2 Is a prime number.
3. 2 is a prime number **or** 5+2 = 8
4. 13 is a perfect square **or** 9 is a prime

**Exclusive Or**  
Definition : Let p and q be propositions. The proposition “**p exclusive or q**” denoted by **p ⊕ q is true when exactly one of p and q is true** and it is false otherwise.