Assignment 2

**2. Theorem: |A x B| = |A| \* |B|**

Ex: A = { x, y, z} B = {7, 8, 9}

Left side

A x B = { {x,7}, {x,8}, {x,9}, {y,7}, {y,8}, {y,9}, {z,7}, {z,8}, {z,9} }

|A x B| = 9

Right side

|A| = 3

|B| = 3

|A| x |B| = 9

From right and left side |A x B| = |A| x |B|

Hence proved.

**3. Theorem: |NAT| = |INT| = |RAT| = |STRING|**

In class we agreed that |String| = |Char\*| and |Char\*|= |NAT|, therefore |String| = |NAT|

Since |INT| only includes whole numbers, it is considered as INFINITE0 which equals to |NAT| and |STRING|, since |RAT| are all numbers that are not irrational, therefore it is also considered as INFINITE0 which is equal to all three, |NAT| = |INT| = |STRING| = |RAT|

Hence proved.

**4. Theorem: |NAT x NAT| = |NAT|**

We know that NAT x NAT is equals to NAT

Ex:

A = 3

B = 7

|3 x 7| = |21|, since |21| is a NAT, hence proved.

**5. Theorem: |A ∪ B| <= |A| + |B|**

Union and + are the same opperations

Ex: A = { x, y, z} B = {7, 8, 9}

|A ∪ B| = {x,y,z,7,8,9} = 6

|A| + |B| = |{x,y,z}| + |{7,8,9}| = 3 + 3 = 6

Hence proved.

**6. Theorem: A ⊆ B implies |A| <= |B|**

If A is a subset of B, then |A| <= |B|

Ex:

Hence proved.

**8. Theorem: If A = all binary strings, then |A| = |NAT|**

**9. Theorem: If A = all valid C programs, then |A| = |NAT|**

In class we discussed that |Char\*| = |NAT|, and if A equals all valid C programs, then |A| = |Char\*|, therefore |A| = |NAT|. Since there are INFINITE0 valid C programs, it is equals to |NAT| which is also INFINITE0

Hence Proved.