**Assignment**

1.

Let P: It rains today Q: I will drive to work

Given: P 🡪 Q

i. *Converse*: If I will drive to work, then it rains today [ Q 🡪 P ]

ii. *Contrapositive*: If I will not drive to work, then it does not rain today [ ~ Q 🡪 P ]

iii. *Inverse*: If it does not rain today, then I will not drive to work [ ~ P 🡪 ~ Q ]

2.

Given X = { (000000), (100000), (110000), (111000), (111100), (111110),

(111111), (011111), (001111), (000111), (000011), (000001) }

The sequence follows as:

(0) (25) (25 +24) (25 +24+23) (25 +24+23+22) (25 +24+23+22+21)

(26 - 1) (26 - 25 - 1) (26 - 25 - 24 - 1) (26 - 25 - 24 - 23 - 1) (26 - 25 - 24 - 23 - 22 - 1)

(26 - 25 - 24 - 23 -22 - 21 - 1)

The propositional formula is given by:

[ (A 🡪 B)  (B 🡪 C)  (C 🡪 D)  (D 🡪 E) ]

(E 🡪 D)  (D 🡪 C)  (C 🡪 B)  (B 🡪 A) ]

Reference: *http://math.stackexchange.com/questions/1792438/propositional-formula-to-represent-set-of-binary-strings*

3.

(i) *m < n*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **M = {0, 1, 2, 3}**  **N = {1, 3, 4}** | **P(m, n)**  ***P*** | **M = {0, 1, 4}**  **N = {0, 1, 2, 3}** | **P(m, n)**  ***Q*** | **P 🡪 Q** |
| (0,1) | T | (0,0) | F | F |
| (0,3) | T | (0,1) | T | T |
| (0,4) | T | (0,2) | T | T |
| (1,1) | F | (0,3) | T | T |
| (1,3) | T | (1,0) | F | F |
| (1,4) | T | (1,1) | F | F |
| (2,1) | F | (1,2) | T | T |
| (2,3) | T | (1,3) | T | T |
| (2,4) | T | (4,0) | F | F |
| (3,1) | F | (4,1) | F | T |
| (3,3) | F | (4,2) | F | T |
| (3,4) | T | (4,3) | F | F |

(ii) *m | n*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **M = {0, 1, 2, 3}**  **N = {1, 3, 4}** | **P(m, n)**  ***P*** | **M = {0, 1, 4}**  **N = {0, 1, 2, 3}** | **P(m, n)**  ***Q*** | **P 🡪 Q** |
| (0,1) | T | (0,0) | T | T |
| (0,3) | T | (0,1) | T | T |
| (0,4) | T | (0,2) | T | T |
| (1,1) | T | (0,3) | T | T |
| (1,3) | F | (1,0) | F | T |
| (1,4) | F | (1,1) | T | T |
| (2,1) | T | (1,2) | F | F |
| (2,3) | F | (1,3) | F | T |
| (2,4) | F | (4,0) | F | T |
| (3,1) | T | (4,1) | T | T |
| (3,3) | T | (4,2) | T | T |
| (3,4) | F | (4,3) | F | T |

4.

(a) Some freshmen are math majors. I, V, VI, VIII, X

(b) Every math major is a freshman. II, IV, V, VI, IX

(c) No math major is a freshman. I, II, III, VI, VIII, IX,

5.

