Assignment 3 RB Instances Examples

1.

- Input Parameters:
    - Number of variables (n): 4
    - Constraint tightness (p): 0.33
    - Constant α: 0.8
    - Constant r: 0.7
    - Max number of parents: 3
    - Pareto (k): 3
- Generated RB Instance
    - Domain size: 3
    - Number of constraints: 4
    - Number of incompatible tuples: 3
    - Variables: {X0, X1, X2, X3}
    - Domain: {0, 1, 2}
    - Constraints (incompatible tuples):
        - (X0, X2): [(0,1), (0,2), (2,1)]
        - (X1, X2): [(0,0), (1,1), (2,2)]
        - (X1, X3): [(0,0), (2,0), (2,2)]
        - (X2, X3): [(0,2), (1,0), (2,2)]
    - Dependencies: List of parents for each variable:
        - X0: Nil
        - X1: {X0}
        - X2: {X0, X1}
        - X3: {X0, X1, X2}
    - CPT for each variable:
        - X0:
            - 2 > 1 > 0
        - X1:
            - 0: 0 > 2 > 1
            - 1: 2 > 0 > 1
            - 2: 1 > 0 > 2
        - X2:
            - 0,0: 2 > 0 > 1
            - 0,1: 1 > 2 > 0
            - 0,2: 1 > 0 > 2
            - 1,0: 1 > 2 > 0
            - 1,1: 2 > 0 > 1
            - 1,2: 2 > 0 > 1
            - 2,0: 0 > 2 > 1
            - 2,1: 1 > 2 > 0
            - 2,2: 2 > 0 > 1
        - X3:
            - 0,0,0: 2 > 1 > 0
            - 0,0,1: 0 > 1 > 2
            - 0,0,2: 0 > 2 > 1

- 0,1,0: 2 > 0 > 1
- 0,1,1: 0 > 2 > 1
- 0,1,2: 0 > 2 > 1
- 0,2,0: 1 > 0 > 2
- 0,2,1: 1 > 0 > 2
- 0,2,2: 1 > 0 > 2
- 1,0,0: 0 > 1 > 2
- 1,0,1: 0 > 1 > 2
- 1,0,2: 0 > 2 > 1
- 1,1,0: 1 > 2 > 0
- 1,1,1: 0 > 2 > 1
- 1,1,2: 0 > 2 > 1
- 1,2,0: 0 > 1 > 2
- 1,2,1: 1 > 0 > 2
- 1,2,2: 0 > 2 > 1
- 2,0,0: 2 > 1 > 0
- 2,0,1: 2 > 1 > 0
- 2,0,2: 2 > 0 > 1
- 2,1,0: 0 > 2 > 1
- 2,1,1: 0 > 1 > 2
- 2,1,2: 1 > 0 > 2
- 2,2,0: 2 > 0 > 1
- 2,2,1: 0 > 1 > 2
- 2,2,2: 2 > 0 > 1

- First solution:
  - X0 = 2, X1 = 1, X2 = 2, X3 = 1

2.

- Input Parameters:
  - Number of variables (n): 6
  - Constraint tightness (p): 0.33
  - Constant α: 0.8
  - Constant r: 0.7
  - Max number of parents: 3
  - Pareto (k): 2
- Generated RB Instance
  - Domain size: 4
  - Number of constraints: 8
  - Number of incompatible tuples: 5
  - Variables: {X0, X1, X2, X3, X4, X5}
  - Domain: {0, 1, 2, 3}
  - Constraints (incompatible tuples):
    - (X0, X1): [(0,0), (0,1), (0,2), (1,0), (1,1)]
    - (X0, X3): [(0,2), (2,1), (2,2), (2,3), (3,3)]
    - (X0, X4): [(0,1), (1,2), (1,3), (3,1), (3,3)]
    - (X0, X5): [(0,2), (1,1), (1,2), (2,0), (2,1)]
    - (X1, X4): [(0,0), (0,1), (2,0), (2,2), (3,2)]
    - (X1, X5): [(0,2), (1,1), (2,1), (2,3), (3,3)]

        - (X3, X5): [(0,1), (0,2), (1,3), (2,0), (3,3)]
        - (X4, X5): [(0,2), (1,0), (1,2), (1,3), (2,2)]
- Dependencies: List of parents for each variable:
    - X0: Nil
    - X1: {X0}
    - X2: {X0, X1}
    - X3: {X0, X1, X2}
    - X4: {X0, X1, X3}
    - X5: {X0, X1, X2}
- CPT for each variable:
    - X0:
        - 3 > 1 > 0 > 2
    - X1:
        - 0: 1 > 0 > 2 > 3
        - 1: 0 > 3 > 1 > 2
        - 2: 0 > 1 > 2 > 3
        - 3: 1 > 3 > 0 > 2
    - X2:
        - 0,0: 0 > 2 > 3 > 1
        - 0,1: 1 > 2 > 3 > 0
        - 0,2: 1 > 2 > 3 > 0
        - 0,3: 1 > 0 > 2 > 3
        - 1,0: 3 > 0 > 2 > 1
        - 1,1: 0 > 2 > 3 > 1
        - 1,2: 1 > 0 > 2 > 3
        - 1,3: 2 > 0 > 3 > 1
        - 2,0: 2 > 0 > 3 > 1
        - 2,1: 1 > 2 > 3 > 0
        - 2,2: 2 > 0 > 1 > 3
        - 2,3: 3 > 0 > 2 > 1
        - 3,0: 2 > 0 > 1 > 3
        - 3,1: 2 > 3 > 0 > 1
        - 3,2: 0 > 2 > 1 > 3
        - 3,3: 1 > 2 > 0 > 3
    - X3:
        - 0,0,0: 0 > 2 > 1 > 3
        - 0,0,1: 0 > 3 > 2 > 1
        - 0,0,2: 1 > 0 > 3 > 2
        - 0,0,3: 3 > 1 > 0 > 2
        - 0,1,0: 0 > 3 > 1 > 2
        - 0,1,1: 3 > 0 > 2 > 1
        - 0,1,2: 1 > 2 > 3 > 0
        - 0,1,3: 3 > 0 > 2 > 1
        - 0,2,0: 2 > 0 > 1 > 3
        - 0,2,1: 1 > 3 > 0 > 2
        - 0,2,2: 1 > 3 > 2 > 0
        - 0,2,3: 0 > 2 > 3 > 1

- 0,3,0: 0 > 2 > 1 > 3
- 0,3,1: 2 > 1 > 3 > 0
- 0,3,2: 0 > 3 > 2 > 1
- 0,3,3: 2 > 1 > 0 > 3
- 1,0,0: 0 > 2 > 3 > 1
- 1,0,1: 2 > 0 > 3 > 1
- 1,0,2: 3 > 2 > 1 > 0
- 1,0,3: 3 > 1 > 0 > 2
- 1,1,0: 0 > 2 > 1 > 3
- 1,1,1: 3 > 2 > 1 > 0
- 1,1,2: 3 > 2 > 1 > 0
- 1,1,3: 1 > 3 > 2 > 0
- 1,2,0: 3 > 2 > 0 > 1
- 1,2,1: 3 > 0 > 1 > 2
- 1,2,2: 2 > 3 > 1 > 0
- 1,2,3: 0 > 2 > 1 > 3
- 1,3,0: 1 > 3 > 0 > 2
- 1,3,1: 2 > 3 > 1 > 0
- 1,3,2: 3 > 1 > 0 > 2
- 1,3,3: 0 > 3 > 1 > 2
- 2,0,0: 1 > 2 > 0 > 3
- 2,0,1: 2 > 3 > 1 > 0
- 2,0,2: 2 > 0 > 3 > 1
- 2,0,3: 2 > 1 > 0 > 3
- 2,1,0: 2 > 3 > 1 > 0
- 2,1,1: 1 > 3 > 2 > 0
- 2,1,2: 0 > 1 > 2 > 3
- 2,1,3: 0 > 1 > 3 > 2
- 2,2,0: 1 > 3 > 2 > 0
- 2,2,1: 1 > 2 > 3 > 0
- 2,2,2: 1 > 0 > 2 > 3
- 2,2,3: 0 > 3 > 2 > 1
- 2,3,0: 0 > 3 > 2 > 1
- 2,3,1: 0 > 3 > 2 > 1
- 2,3,2: 2 > 1 > 0 > 3
- 2,3,3: 1 > 3 > 2 > 0
- 3,0,0: 0 > 3 > 1 > 2
- 3,0,1: 0 > 2 > 3 > 1
- 3,0,2: 2 > 3 > 1 > 0
- 3,0,3: 3 > 1 > 2 > 0
- 3,1,0: 0 > 2 > 1 > 3
- 3,1,1: 1 > 0 > 2 > 3
- 3,1,2: 0 > 1 > 2 > 3
- 3,1,3: 2 > 0 > 1 > 3
- 3,2,0: 2 > 3 > 0 > 1
- 3,2,1: 3 > 1 > 2 > 0
- 3,2,2: 0 > 2 > 3 > 1

        - 3,2,3: 2 > 0 > 1 > 3
        - 3,3,0: 3 > 0 > 2 > 1
        - 3,3,1: 0 > 2 > 3 > 1
        - 3,3,2: 3 > 2 > 1 > 0
        - 3,3,3: 2 > 3 > 0 > 1
- X4:
    - 0,0,0: 3 > 1 > 2 > 0
    - 0,0,1: 2 > 0 > 1 > 3
    - 0,0,2: 1 > 3 > 0 > 2
    - 0,0,3: 3 > 2 > 0 > 1
    - 0,1,0: 3 > 0 > 2 > 1
    - 0,1,1: 3 > 0 > 1 > 2
    - 0,1,2: 1 > 3 > 0 > 2
    - 0,1,3: 2 > 3 > 1 > 0
    - 0,2,0: 0 > 1 > 3 > 2
    - 0,2,1: 3 > 1 > 2 > 0
    - 0,2,2: 3 > 0 > 2 > 1
    - 0,2,3: 1 > 3 > 0 > 2
    - 0,3,0: 3 > 2 > 1 > 0
    - 0,3,1: 1 > 3 > 2 > 0
    - 0,3,2: 2 > 3 > 1 > 0
    - 0,3,3: 2 > 3 > 1 > 0
    - 1,0,0: 1 > 2 > 3 > 0
    - 1,0,1: 3 > 2 > 1 > 0
    - 1,0,2: 1 > 0 > 3 > 2
    - 1,0,3: 2 > 1 > 0 > 3
    - 1,1,0: 2 > 1 > 3 > 0
    - 1,1,1: 2 > 3 > 0 > 1
    - 1,1,2: 2 > 1 > 0 > 3
    - 1,1,3: 1 > 0 > 3 > 2
    - 1,2,0: 0 > 3 > 2 > 1
    - 1,2,1: 3 > 1 > 0 > 2
    - 1,2,2: 3 > 0 > 2 > 1
    - 1,2,3: 0 > 3 > 1 > 2
    - 1,3,0: 1 > 2 > 3 > 0
    - 1,3,1: 0 > 1 > 3 > 2
    - 1,3,2: 2 > 3 > 0 > 1
    - 1,3,3: 2 > 1 > 0 > 3
    - 2,0,0: 2 > 1 > 3 > 0
    - 2,0,1: 0 > 2 > 1 > 3
    - 2,0,2: 2 > 0 > 3 > 1
    - 2,0,3: 1 > 2 > 3 > 0
    - 2,1,0: 0 > 3 > 1 > 2
    - 2,1,1: 1 > 2 > 0 > 3
    - 2,1,2: 3 > 2 > 1 > 0
    - 2,1,3: 3 > 2 > 1 > 0
    - 2,2,0: 3 > 1 > 2 > 0

        - 2,2,1: 1 > 0 > 3 > 2
        - 2,2,2: 1 > 3 > 2 > 0
        - 2,2,3: 2 > 3 > 1 > 0
        - 2,3,0: 1 > 3 > 2 > 0
        - 2,3,1: 3 > 2 > 0 > 1
        - 2,3,2: 1 > 2 > 0 > 3
        - 2,3,3: 1 > 0 > 2 > 3
        - 3,0,0: 1 > 3 > 2 > 0
        - 3,0,1: 1 > 0 > 2 > 3
        - 3,0,2: 1 > 0 > 2 > 3
        - 3,0,3: 2 > 3 > 1 > 0
        - 3,1,0: 2 > 0 > 3 > 1
        - 3,1,1: 3 > 0 > 2 > 1
        - 3,1,2: 0 > 3 > 1 > 2
        - 3,1,3: 2 > 1 > 0 > 3
        - 3,2,0: 1 > 3 > 0 > 2
        - 3,2,1: 0 > 1 > 3 > 2
        - 3,2,2: 2 > 0 > 1 > 3
        - 3,2,3: 3 > 2 > 0 > 1
        - 3,3,0: 3 > 1 > 2 > 0
        - 3,3,1: 1 > 2 > 0 > 3
        - 3,3,2: 1 > 3 > 0 > 2
        - 3,3,3: 3 > 2 > 0 > 1
- X5:
    - 0,0,0: 0 > 1 > 2 > 3
    - 0,0,1: 2 > 0 > 1 > 3
    - 0,0,2: 1 > 0 > 3 > 2
    - 0,0,3: 3 > 2 > 1 > 0
    - 0,1,0: 3 > 1 > 0 > 2
    - 0,1,1: 3 > 0 > 2 > 1
    - 0,1,2: 1 > 0 > 3 > 2
    - 0,1,3: 0 > 3 > 2 > 1
    - 0,2,0: 1 > 0 > 2 > 3
    - 0,2,1: 1 > 0 > 2 > 3
    - 0,2,2: 2 > 0 > 3 > 1
    - 0,2,3: 3 > 0 > 1 > 2
    - 0,3,0: 0 > 2 > 3 > 1
    - 0,3,1: 3 > 2 > 1 > 0
    - 0,3,2: 2 > 0 > 3 > 1
    - 0,3,3: 0 > 2 > 1 > 3
    - 1,0,0: 2 > 0 > 3 > 1
    - 1,0,1: 3 > 0 > 1 > 2
    - 1,0,2: 3 > 0 > 2 > 1
    - 1,0,3: 2 > 3 > 0 > 1
    - 1,1,0: 3 > 1 > 0 > 2
    - 1,1,1: 0 > 2 > 1 > 3
    - 1,1,2: 2 > 1 > 0 > 3

- 1,1,3: 1 > 0 > 3 > 2
- 1,2,0: 3 > 0 > 1 > 2
- 1,2,1: 1 > 3 > 2 > 0
- 1,2,2: 3 > 1 > 2 > 0
- 1,2,3: 1 > 0 > 2 > 3
- 1,3,0: 0 > 3 > 1 > 2
- 1,3,1: 3 > 1 > 2 > 0
- 1,3,2: 3 > 1 > 0 > 2
- 1,3,3: 2 > 3 > 1 > 0
- 2,0,0: 3 > 2 > 1 > 0
- 2,0,1: 0 > 1 > 3 > 2
- 2,0,2: 3 > 1 > 0 > 2
- 2,0,3: 2 > 0 > 3 > 1
- 2,1,0: 2 > 3 > 0 > 1
- 2,1,1: 2 > 0 > 1 > 3
- 2,1,2: 1 > 0 > 2 > 3
- 2,1,3: 3 > 1 > 2 > 0
- 2,2,0: 3 > 0 > 2 > 1
- 2,2,1: 3 > 1 > 2 > 0
- 2,2,2: 3 > 2 > 1 > 0
- 2,2,3: 3 > 1 > 2 > 0
- 2,3,0: 0 > 3 > 1 > 2
- 2,3,1: 3 > 1 > 2 > 0
- 2,3,2: 2 > 3 > 0 > 1
- 2,3,3: 1 > 2 > 0 > 3
- 3,0,0: 1 > 3 > 0 > 2
- 3,0,1: 1 > 3 > 2 > 0
- 3,0,2: 0 > 1 > 2 > 3
- 3,0,3: 2 > 1 > 3 > 0
- 3,1,0: 1 > 2 > 3 > 0
- 3,1,1: 0 > 1 > 2 > 3
- 3,1,2: 3 > 1 > 0 > 2
- 3,1,3: 2 > 0 > 3 > 1
- 3,2,0: 1 > 0 > 2 > 3
- 3,2,1: 1 > 2 > 0 > 3
- 3,2,2: 1 > 0 > 2 > 3
- 3,2,3: 1 > 2 > 0 > 3
- 3,3,0: 0 > 1 > 3 > 2
- 3,3,1: 1 > 3 > 0 > 2
- 3,3,2: 0 > 1 > 3 > 2
- 3,3,3: 1 > 0 > 2 > 3

- Solution:
  - X0 = 3, X1 = 1, X2 = 2, X3 = 0, X4 = 2, X5 = 3

3.

- Input Parameters:
    - Number of variables (n): 8
    - Constraint tightness (p): 0.33
    - Constant α: 0.8
    - Constant r: 0.7
    - Max number of parents: 2
    - Pareto (k): 3
- Generated RB Instance
    - Domain size: 5
    - Number of constraints: 12
    - Number of incompatible tuples: 8
    - Variables: {X0, X1, X2, X3, X4, X5, X6, X7}
    - Domain: {0, 1, 2, 3, 4}
    - Constraints (incompatible tuples):
        - (X0, X6): [(0,0), (0,1), (0,2), (1,1), (3,1), (3,4), (4,0), (4,2)]
        - (X0, X7): [(0,1), (0,4), (1,0), (1,2), (2,0), (3,0), (4,0), (4,4)]
        - (X1, X5): [(0,0), (0,2), (1,0), (2,3), (3,0), (3,4), (4,2), (4,4)]
        - (X1, X6): [(0,0), (0,4), (1,1), (1,2), (2,0), (2,3), (3,1), (4,1)]
        - (X2, X5): [(0,3), (0,4), (1,3), (2,3), (3,3), (4,0), (4,1), (4,4)]
        - (X2, X6): [(0,1), (1,3), (2,2), (3,1), (3,3), (3,4), (4,0), (4,3)]
        - (X2, X7): [(0,1), (1,0), (1,1), (1,2), (1,3), (3,0), (3,2), (4,2)]
        - (X3, X5): [(0,2), (1,0), (2,2), (2,4), (3,0), (3,3), (4,1), (4,4)]
        - (X3, X7): [(0,1), (1,1), (2,3), (2,4), (3,0), (3,2), (4,0), (4,1)]
        - (X4, X5): [(0,1), (0,3), (1,0), (1,1), (1,2), (1,4), (2,1), (4,4)]
        - (X5, X6): [(0,0), (0,1), (0,2), (0,4), (1,4), (2,2), (2,4), (3,0)]
        - (X6, X7): [(2,0), (2,2), (2,3), (2,4), (3,0), (3,3), (4,1), (4,2)]
    - Dependencies: List of parents for each variable:
        - X0: Nil
        - X1: {X0}
        - X2: {X0, X1}
        - X3: {X0, X2}
        - X4: {X2, X3}
        - X5: {X1, X2}
        - X6: {X2, X3}
        - X7: {X2, X5}
    - CPT for each variable:
        - X0:
            - 2 > 4 > 0 > 1 > 3
        - X1:
            - 0: 3 > 2 > 4 > 1 > 0
            - 1: 3 > 1 > 4 > 2 > 0
            - 2: 2 > 4 > 3 > 0 > 1
            - 3: 1 > 2 > 3 > 4 > 0
            - 4: 3 > 4 > 1 > 2 > 0
        - X2:
            - 0,0: 4 > 1 > 2 > 3 > 0

    - 0,1: 1 > 3 > 0 > 4 > 2
    - 0,2: 4 > 1 > 0 > 2 > 3
    - 0,3: 0 > 1 > 2 > 3 > 4
    - 0,4: 3 > 1 > 4 > 2 > 0
    - 1,0: 1 > 0 > 3 > 4 > 2
    - 1,1: 1 > 0 > 2 > 4 > 3
    - 1,2: 4 > 0 > 3 > 2 > 1
    - 1,3: 3 > 1 > 2 > 4 > 0
    - 1,4: 4 > 2 > 3 > 1 > 0
    - 2,0: 2 > 1 > 3 > 0 > 4
    - 2,1: 3 > 0 > 1 > 4 > 2
    - 2,2: 2 > 0 > 3 > 1 > 4
    - 2,3: 2 > 4 > 1 > 3 > 0
    - 2,4: 0 > 2 > 1 > 3 > 4
    - 3,0: 1 > 0 > 4 > 2 > 3
    - 3,1: 0 > 1 > 4 > 2 > 3
    - 3,2: 2 > 4 > 0 > 3 > 1
    - 3,3: 4 > 1 > 2 > 0 > 3
    - 3,4: 4 > 0 > 3 > 1 > 2
    - 4,0: 0 > 2 > 4 > 1 > 3
    - 4,1: 4 > 2 > 1 > 3 > 0
    - 4,2: 0 > 3 > 1 > 4 > 2
    - 4,3: 2 > 3 > 0 > 1 > 4
    - 4,4: 4 > 0 > 3 > 1 > 2
- X3:
    - 0,0: 3 > 2 > 0 > 4 > 1
    - 0,1: 3 > 0 > 2 > 1 > 4
    - 0,2: 1 > 2 > 0 > 3 > 4
    - 0,3: 0 > 2 > 3 > 1 > 4
    - 0,4: 3 > 1 > 2 > 4 > 0
    - 1,0: 2 > 1 > 0 > 3 > 4
    - 1,1: 2 > 3 > 0 > 1 > 4
    - 1,2: 1 > 0 > 3 > 4 > 2
    - 1,3: 4 > 1 > 3 > 0 > 2
    - 1,4: 3 > 0 > 2 > 4 > 1
    - 2,0: 0 > 1 > 2 > 4 > 3
    - 2,1: 1 > 0 > 3 > 2 > 4
    - 2,2: 2 > 1 > 4 > 3 > 0
    - 2,3: 2 > 3 > 1 > 0 > 4
    - 2,4: 3 > 1 > 4 > 0 > 2
    - 3,0: 3 > 1 > 0 > 4 > 2
    - 3,1: 0 > 4 > 3 > 1 > 2
    - 3,2: 0 > 2 > 3 > 1 > 4
    - 3,3: 0 > 4 > 2 > 1 > 3
    - 3,4: 3 > 2 > 4 > 1 > 0
    - 4,0: 2 > 4 > 3 > 0 > 1
    - 4,1: 1 > 2 > 0 > 3 > 4

        - 4,2: 2 > 4 > 0 > 1 > 3
        - 4,3: 3 > 1 > 0 > 4 > 2
        - 4,4: 0 > 4 > 3 > 2 > 1
- X4:
    - 0,0: 4 > 0 > 2 > 3 > 1
    - 0,1: 1 > 0 > 2 > 4 > 3
    - 0,2: 3 > 2 > 4 > 1 > 0
    - 0,3: 0 > 2 > 3 > 1 > 4
    - 0,4: 4 > 3 > 0 > 2 > 1
    - 1,0: 0 > 3 > 4 > 1 > 2
    - 1,1: 0 > 3 > 4 > 2 > 1
    - 1,2: 4 > 1 > 3 > 2 > 0
    - 1,3: 3 > 1 > 2 > 4 > 0
    - 1,4: 3 > 0 > 1 > 4 > 2
    - 2,0: 1 > 4 > 2 > 3 > 0
    - 2,1: 2 > 3 > 1 > 0 > 4
    - 2,2: 3 > 2 > 4 > 1 > 0
    - 2,3: 3 > 2 > 4 > 1 > 0
    - 2,4: 2 > 0 > 1 > 4 > 3
    - 3,0: 3 > 4 > 1 > 2 > 0
    - 3,1: 4 > 3 > 2 > 1 > 0
    - 3,2: 3 > 0 > 4 > 1 > 2
    - 3,3: 3 > 1 > 2 > 4 > 0
    - 3,4: 2 > 4 > 1 > 3 > 0
    - 4,0: 2 > 4 > 0 > 3 > 1
    - 4,1: 3 > 2 > 4 > 0 > 1
    - 4,2: 3 > 2 > 4 > 0 > 1
    - 4,3: 0 > 1 > 4 > 3 > 2
    - 4,4: 0 > 4 > 2 > 1 > 3
- X5:
    - 0,0: 0 > 4 > 1 > 2 > 3
    - 0,1: 4 > 1 > 3 > 2 > 0
    - 0,2: 3 > 4 > 1 > 2 > 0
    - 0,3: 4 > 2 > 1 > 0 > 3
    - 0,4: 2 > 0 > 4 > 3 > 1
    - 1,0: 2 > 4 > 0 > 3 > 1
    - 1,1: 4 > 2 > 3 > 1 > 0
    - 1,2: 3 > 0 > 1 > 2 > 4
    - 1,3: 3 > 1 > 0 > 4 > 2
    - 1,4: 2 > 4 > 3 > 0 > 1
    - 2,0: 1 > 4 > 2 > 0 > 3
    - 2,1: 0 > 4 > 2 > 3 > 1
    - 2,2: 1 > 0 > 3 > 2 > 4
    - 2,3: 2 > 0 > 1 > 4 > 3
    - 2,4: 1 > 0 > 2 > 3 > 4
    - 3,0: 1 > 3 > 0 > 2 > 4
    - 3,1: 1 > 4 > 0 > 3 > 2

        - 3,2: 1 > 2 > 3 > 0 > 4
        - 3,3: 2 > 0 > 1 > 3 > 4
        - 3,4: 2 > 3 > 1 > 4 > 0
        - 4,0: 3 > 0 > 4 > 1 > 2
        - 4,1: 1 > 2 > 4 > 3 > 0
        - 4,2: 3 > 1 > 0 > 2 > 4
        - 4,3: 0 > 4 > 3 > 2 > 1
        - 4,4: 2 > 0 > 3 > 4 > 1
    - X6:
        - 0,0: 3 > 1 > 4 > 0 > 2
        - 0,1: 4 > 0 > 3 > 2 > 1
        - 0,2: 2 > 3 > 0 > 4 > 1
        - 0,3: 3 > 4 > 0 > 1 > 2
        - 0,4: 4 > 1 > 0 > 2 > 3
        - 1,0: 4 > 1 > 2 > 3 > 0
        - 1,1: 4 > 2 > 3 > 1 > 0
        - 1,2: 1 > 4 > 2 > 0 > 3
        - 1,3: 3 > 2 > 1 > 4 > 0
        - 1,4: 4 > 0 > 2 > 1 > 3
        - 2,0: 1 > 2 > 0 > 4 > 3
        - 2,1: 2 > 4 > 0 > 3 > 1
        - 2,2: 0 > 2 > 1 > 3 > 4
        - 2,3: 0 > 3 > 2 > 1 > 4
        - 2,4: 2 > 3 > 0 > 1 > 4
        - 3,0: 2 > 1 > 4 > 3 > 0
        - 3,1: 4 > 3 > 0 > 2 > 1
        - 3,2: 0 > 2 > 3 > 1 > 4
        - 3,3: 1 > 2 > 0 > 3 > 4
        - 3,4: 2 > 3 > 4 > 1 > 0
        - 4,0: 2 > 4 > 0 > 1 > 3
        - 4,1: 0 > 4 > 1 > 3 > 2
        - 4,2: 1 > 0 > 3 > 4 > 2
        - 4,3: 2 > 4 > 0 > 1 > 3
        - 4,4: 4 > 0 > 1 > 2 > 3
    - X7:
        - 0,0: 2 > 0 > 1 > 4 > 3
        - 0,1: 4 > 0 > 2 > 3 > 1
        - 0,2: 1 > 3 > 4 > 0 > 2
        - 0,3: 3 > 0 > 4 > 2 > 1
        - 0,4: 2 > 1 > 0 > 4 > 3
        - 1,0: 3 > 0 > 1 > 4 > 2
        - 1,1: 2 > 1 > 0 > 3 > 4
        - 1,2: 1 > 2 > 4 > 3 > 0
        - 1,3: 2 > 0 > 3 > 4 > 1
        - 1,4: 0 > 4 > 3 > 1 > 2
        - 2,0: 2 > 3 > 1 > 4 > 0
        - 2,1: 4 > 2 > 0 > 1 > 3

- 2,2: 1 > 3 > 4 > 0 > 2
- 2,3: 3 > 1 > 2 > 4 > 0
- 2,4: 0 > 3 > 2 > 4 > 1
- 3,0: 2 > 3 > 0 > 4 > 1
- 3,1: 0 > 4 > 3 > 2 > 1
- 3,2: 0 > 3 > 2 > 4 > 1
- 3,3: 2 > 4 > 3 > 0 > 1
- 3,4: 1 > 4 > 0 > 3 > 2
- 4,0: 1 > 3 > 0 > 4 > 2
- 4,1: 0 > 1 > 2 > 4 > 3
- 4,2: 2 > 3 > 4 > 1 > 0
- 4,3: 3 > 0 > 1 > 2 > 4
- 4,4: 1 > 0 > 2 > 3 > 4

- Solution:
  - X0 = 2, X1 = 2, X2 = 2, X3 = 2, X4 = 3, X5 = 1, X6 = 1, X7 = 2