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Constraint Programming

# Section 1 : Forward Checking

### Description of Code

In this python code, I used an object-oriented programming style for the CSP….

### Output trace of 6 Queens

Left Branch now Q0=0

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [1, 3, 4, 5]

Q3: [1, 2, 4, 5]

Q4: [1, 2, 3, 5]

Q5: [1, 2, 3, 4]

Left Branch now Q1=2

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [1, 4, 5]

Q3: [1, 5]

Q4: [1, 3]

Q5: [1, 3, 4]

Left Branch now Q2=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [1, 4, 5]

Q3: [5]

Q4: [3]

Q5: [3, 4]

Left Branch now Q3=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [1, 4, 5]

Q3: [5]

Q4: [3]

Q5: [4]

Left Branch now Q4=3

Domain Wipeout

Right Branch now Q4!=3

Right Branch now Q3!=5

Right Branch now Q2!=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [4, 5]

Q3: [1]

Q4: [1, 3]

Q5: [1, 3, 4]

Left Branch now Q2=4

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [4, 5]

Q3: [1]

Q4: [1, 3]

Q5: [1, 3]

Left Branch now Q3=1

Domain Wipeout

Right Branch now Q3!=1

Right Branch now Q2!=4

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [5]

Q3: [1]

Q4: [1]

Q5: [1, 3, 4]

Left Branch now Q2=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [2, 3, 4, 5]

Q2: [5]

Q3: [1]

Q4: [1]

Q5: [1, 3, 4]

Left Branch now Q3=1

Domain Wipeout

Right Branch now Q3!=1

Right Branch now Q2!=5

Right Branch now Q1!=2

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [1, 3, 5]

Q3: [1, 2, 4, 5]

Q4: [1, 2, 3, 5]

Q5: [1, 2, 3, 4]

Left Branch now Q1=3

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [1, 5]

Q3: [1, 2, 4]

Q4: [1, 2, 5]

Q5: [1, 2, 4]

Left Branch now Q2=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [1, 5]

Q3: [2]

Q4: [2]

Q5: [2, 4]

Left Branch now Q3=2

Domain Wipeout

Right Branch now Q3!=2

Right Branch now Q2!=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [1, 2]

Q4: [1, 2]

Q5: [1, 4]

Left Branch now Q2=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [1, 2]

Q4: [1, 2]

Q5: [1, 4]

Left Branch now Q3=1

Domain Wipeout

Right Branch now Q3!=1

Domain Wipeout

Right Branch now Q2!=5

Right Branch now Q1!=3

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [1, 3]

Q3: [1, 2, 4, 5]

Q4: [1, 2, 3, 5]

Q5: [1, 2, 3, 4]

Left Branch now Q1=4

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [1, 3]

Q3: [1, 2, 5]

Q4: [1, 2, 3, 5]

Q5: [1, 2, 3]

Left Branch now Q2=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [1, 3]

Q3: [5]

Q4: [2]

Q5: [2, 3]

Left Branch now Q3=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [1, 3]

Q3: [5]

Q4: [2]

Q5: [2]

Left Branch now Q4=2

Domain Wipeout

Right Branch now Q4!=2

Right Branch now Q3!=5

Right Branch now Q2!=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [3]

Q3: [1, 5]

Q4: [2]

Q5: [1, 2]

Left Branch now Q2=3

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [3]

Q3: [1, 5]

Q4: [2]

Q5: [1, 2]

Left Branch now Q3=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [3]

Q3: [1, 5]

Q4: [2]

Q5: [2]

Left Branch now Q4=2

Domain Wipeout

Right Branch now Q4!=2

Right Branch now Q3!=1

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [3]

Q3: [5]

Q4: [2]

Q5: [1, 2]

Left Branch now Q3=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [4, 5]

Q2: [3]

Q3: [5]

Q4: [2]

Q5: [1, 2]

Left Branch now Q4=2

Domain Wipeout

Right Branch now Q4!=2

Right Branch now Q3!=5

Right Branch now Q2!=3

Right Branch now Q1!=4

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [5]

Q2: [1, 3]

Q3: [1, 2, 4]

Q4: [1, 3]

Q5: [2, 3, 4]

Left Branch now Q1=5

Revised domains:

Q0: [0, 1, 2, 3, 4, 5]

Q1: [5]

Q2: [1, 3]

Q3: [1, 2, 4]

Q4: [1, 3]

Q5: [2, 3, 4]

Left Branch now Q2=1

Domain Wipeout

Right Branch now Q2!=1

Domain Wipeout

Right Branch now Q1!=5

Right Branch now Q0!=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 1, 2, 3, 4, 5]

Q2: [0, 1, 2, 3, 4, 5]

Q3: [0, 1, 2, 3, 4, 5]

Q4: [0, 1, 2, 3, 4, 5]

Q5: [0, 1, 2, 3, 4, 5]

Left Branch now Q0=1

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [0, 2, 4, 5]

Q3: [0, 2, 3, 5]

Q4: [0, 2, 3, 4]

Q5: [0, 2, 3, 4, 5]

Left Branch now Q1=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [2, 4, 5]

Q3: [2, 3, 5]

Q4: [2, 3, 4]

Q5: [2, 3, 4, 5]

Left Branch now Q2=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [2, 4, 5]

Q3: [5]

Q4: [3]

Q5: [3, 4]

Left Branch now Q3=5

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [2, 4, 5]

Q3: [5]

Q4: [3]

Q5: [4]

Left Branch now Q4=3

Domain Wipeout

Right Branch now Q4!=3

Right Branch now Q3!=5

Right Branch now Q2!=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [4, 5]

Q3: [2, 3]

Q4: [2, 3, 4]

Q5: [2, 3, 4, 5]

Left Branch now Q2=4

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [4, 5]

Q3: [2, 3]

Q4: [2, 3]

Q5: [2, 3, 5]

Left Branch now Q3=2

Domain Wipeout

Right Branch now Q3!=2

Domain Wipeout

Right Branch now Q2!=4

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [5]

Q3: [2, 3]

Q4: [2, 4]

Q5: [3, 4]

Left Branch now Q2=5

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [5]

Q3: [2, 3]

Q4: [2, 4]

Q5: [3, 4]

Left Branch now Q3=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [0, 3, 4, 5]

Q2: [5]

Q3: [2, 3]

Q4: [4]

Q5: [3, 4]

Left Branch now Q4=4

Domain Wipeout

Right Branch now Q4!=4

Right Branch now Q3!=2

Domain Wipeout

Right Branch now Q2!=5

Right Branch now Q1!=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [0, 2, 5]

Q3: [0, 2, 3, 5]

Q4: [0, 2, 3, 4]

Q5: [0, 2, 3, 4, 5]

Left Branch now Q1=3

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [0, 2, 5]

Q3: [0, 2]

Q4: [0, 2, 4]

Q5: [0, 2, 4, 5]

Left Branch now Q2=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [0, 2, 5]

Q3: [2]

Q4: [2, 4]

Q5: [2, 4, 5]

Left Branch now Q3=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [0, 2, 5]

Q3: [2]

Q4: [4]

Q5: [5]

Left Branch now Q4=4

Domain Wipeout

Right Branch now Q4!=4

Right Branch now Q3!=2

Right Branch now Q2!=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [2, 5]

Q3: [0, 2]

Q4: [0, 2, 4]

Q5: [0, 4]

Left Branch now Q2=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [2, 5]

Q3: [0]

Q4: [0]

Q5: [0, 4]

Left Branch now Q3=0

Domain Wipeout

Right Branch now Q3!=0

Right Branch now Q2!=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [0, 2]

Q4: [0, 2, 4]

Q5: [0, 4]

Left Branch now Q2=5

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [0, 2]

Q4: [0, 2, 4]

Q5: [0, 4]

Left Branch now Q3=0

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [0, 2]

Q4: [2, 4]

Q5: [4]

Left Branch now Q4=2

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [0, 2]

Q4: [2, 4]

Q5: [4]

Left Branch now Q5=4

Revised domains:

Q0: [1, 2, 3, 4, 5]

Q1: [3, 4, 5]

Q2: [5]

Q3: [0, 2]

Q4: [2, 4]

Q5: [4]

Our Solution Assignments : {0: 1, 1: 3, 2: 5, 3: 0, 4: 2, 5: 4}