Homework #5 Problems

Patrick Perrine
Nicole Miller
CS 550
April 15th, 2020

1.

	CA	NV	AZ	UT	CO	NM	TX
Initial	R B Y O	R B Y O	R B Y O	R B Y O	R B Y O	R B Y O	R B Y O
a. After CA=B	B	R Y O	R Y O	R B Y O	R B Y O	R B Y O	R B Y O
b. After AZ =O	B	R Y	O	R B Y	R B Y*	R B Y	R B Y O

*Assuming diagonal states count as adjacent

2.

a. CA = Blue

Queue: (CA, NV), (CA, AZ)
Process (CA, NV), remove B from NV's domain
Process (CA, AZ), remove B from AZ's domain

b. AZ = Orange

Queue: (AZ, CA), (AZ, NV), (AZ, UT), (AZ, CO), (AZ, NM)
Process (AZ, CA), remove O from CA's domain
Process (AZ, NV), remove O from NV's domain
Process (AZ, UT), remove O from UT's domain
Process (AZ, CO), remove O from CO's domain*
Process (AZ, NM), remove O from NM's domain

3.

a. CA = Blue

Conflict sets:
NV = {CA = B}
AZ = {CA = B}

b. AZ = Orange

Conflict sets:
CA = {AZ = O}
NV = {CA = B, AZ = O}
UT = {AZ = O}
CO = {AZ = O}*
NM = {AZ = O}

4.

Assumptions of Problem:

We assume that a specific student is attempting to enroll in a class using the school's enrollment system. The following specification is the data and logic required to allow said student to attempt to enroll in any one of the courses at a time. For a class to be enrolled in, all constraints must hold true. We assume that the scope of this problem is restricted to only the four courses provided. The only possible overlap between courses (1 and 3) was identified and specifically incorporated into the constraints.

a. Variables:

(Course Dependent)

Course Number (CN)

Course Days (CD)

Spaces Left (S)

(Student Dependent)

Courses Enrolled (CE)

Workdays (WD)

Domains:

$CN \in \{1, 2, 3, 4\}$

$CD \in \{\{M, W\}, \{T, TH\}\}$

$S \in \{0, 1, 2…., 29, 30\}$

$CE \in \{Ø, \{1\}, \{2\}, \{3\}, \{4], \{1, 2\}, \{1, 4\}, \{2, 3\}, \{2, 4\}, \{3, 4\}, \{1, 2, 4\}, \{2, 3, 4\}\}$

$WD \in \{Ø, \{M\}, \{T\}, \{W\}, \{Th\}, \{M, T\}, \{M, W\}, \{M, Th\}, \{T, W\}, \{T, Th\}, \{W, Th\}, \{M, T, W\}, \{M, T, Th\}, \{M, W, Th\}, \{T, W, Th\}, \{M, T, W, Th\}\}$

Constraints:

(Course Overlap)

If $1 \in CE$, then $CN \neq 3$

If $3 \in CE$, then $CN \neq 1$

(Workday Conflicts)

$\forall x \in CD, x \notin WD$

(Seat Availability)

$S \neq 0$

b. We assume that the question is asking for an encapsulated set (E) of valid enrollment configurations for a student. Given that the domains of variables WD and S would create an unreasonable amount of possibilities to list, we become only concerned with the constraint of Course Overlapping, specifically with courses 1 and 3. This makes the encapsulation set equal to the domain of the Courses Enrolled (CE) variable defined previously.

$$E = \{Ø, \{1\}, \{2\}, \{3\}, \{4\}, \{1, 2\}, \{1, 4\}, \{2, 3\}, \{2, 4\}, \{3, 4\}, \{1, 2, 4\}, \{2, 3, 4\}\}$$

$$|E| = 12 \text{ valid schedules}$$

Note: Any possible combination with courses 1 and 3 are absent from this set.