AI QUALITATIVE ASSISGNMENT 2

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Problem 1: Temperature Constraints.

Variables: {x, y}

Domains: {10, 20, 30}

Constraints:

1. x = y + 10
2. x < 30

Solution: Variables: {x, y}

Domains: {10, 20, 30}

Constraints: (x = y + 10, x < 30)

Possible pairs are (x, y)

Graph:

y - - - - - x

(x = y + 10)

Since 40 is not there in domain so,

If y = 10 then

x = y + 10 => x = 10 + 10 = 20

x < 30 => 20 < 30

it works very well, so **final domain is x = {20} and y = {10}.**

Problem 2: Two-City Travel Scheduling.

Variables: {p, q}

Domains = {1, 2, 3, 4}

Constraints:

Graph

p - - - - - q

1. p > q
2. p =! 4

Solution: Variables: {p, q}

Domains = {1, 2, 3, 4}

Constraints: p > q, p =! 4

If in case p = 4, then p > q => (2 > 1), (3 > 1), (4 > 2) and p =! q=> (2 =!1), (3 =!1), (4=!2).

Final domain is p = {2, 3}, q = {1, 2}.

Problem 3: Worker Shift Assignment

Variables: {A, B, C}

Domains: {M, Tu, W, Th, F}

Constraints:

1. A = B + 1
2. C =! A

Graph

A - - - - - - - - - - - B

|

|

C

Solution: Variables: {A, B, C} (days)

Domains: {M, Tu, W, Th, F}

Constraints: (A = B + 1, C =! A)

From A = B + 1, here the possible pair given is A = {Tu, W, Th, M} and B = {M, Tu, W, Th}

So, C =! A does not remove any value

Therefore the **final domain is A = {Tu, W, Th, F}, B = {M, Tu, W, Th} and C = {M, Tu, W, Th, F}.**

Problem 4: Number Ordering Chain

Variables: {a, b, c}

Domains: {1, 2, 3, 4}

Constraints:

1. a < b
2. b < c

Solution: Variables: {a, b, c}

Domains: {1, 2, 3, 4}

Constraints: (a < b, b < c)

Graph

a - - - b - - - c

a cannot be 4 because b > 4 so, a = {1, 2, 3}

b cannot be 1 because no a < 1 and cannot be 4 because c > 4 so, b = {2, 3}

c must be >b so, c = {3, 4} then check once a = 3 needs b > 3 (b would need 4) – 4 was removed -> a = 3

final domain is a = {1, 2}

b = {2, 3}

c = {3, 4}

Problem 5: Simple Geometry Constraints.

Variables: {u, v}

Domains: {2, 4, 6, 8}

Constraints: (u + v = 10)

Solution: Variables: {u, v}

Domains: {2, 4, 6, 8}

Constraints: (u + v = 10)

Graph

u - - - - - - v

Pairs satisfying, sum = 10

So, (2, 8), (4, 6), (6, 4), (8, 2)

Every domain value appears at least one pair

So, **final domain is u = {2, 4, 6, 8}**

v = {2, 4, 6, 8}

Problem 6: Mini Scheduling Problem

Variables: {x, y, z}

Domains: {1, 2, 3}

Constraints:

1. x = y
2. z > x

Graph

```
y
|
x ------- z
```

Solution: Variables: {x, y, z}

Domains: {1, 2, 3}

Constraints: (x = y, z > x)

x = y links each other so x and y will have same values

x = 3 -> no z > 3

since maximum number in domain is 3 so, will remove 3 for x and y the z must be >x

so z must have 2 or 3

therefore **final domain is x = {1, 2}**

y = {1, 2}

z = {2, 3}

Problem 7: Triangle Side Lengths

Variables: {a, b, c}

Domains: {3, 4, 5, 6}

Constraints:

1. a + b > c
2. a + c > b
3. b + c > a

Solution: Variables: {a, b, c}

Domains: {3, 4, 5, 6}

Constraints: (a + b > c, a + c > b, b + c > a)

Every value in domain has at least one pair with 2 values, so that it satisfies the triangle inequalities.

Final domain is a = {3, 4, 5, 6}

b = {3, 4, 5, 6}

c = {3, 4, 5, 6}

Problem 8: Mini Budget Problem.

Variables: {p. q}

Domain: {5, 10, 15}

Constraints:

1. p + q <= 20
2. p > q

Solution: Variables: {p, q}

Domain: {5, 10, 15}

Graph

Constraints: (p + q <= 20, p > q)

p - - - - - q

If p = 5 then 5 > q then q should not be 10, 15 so p = 5 is impossible

If p = 10

p > q

10 > q

Then q = 5, it works for p + q <= 20 = 10 + 5 < 20

For p = 15, then it works for p + q <= 20 = 15 + 5 = 20

Now for q

If q = 5

Then p = 15

p > q it works for this principle also

if q = 15, p = 5 then p > q is not possible so remove q = 15

then final domain is p = {10, 15}

q = {5, 10}