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**CENG462 HW2**

**1)**

**a.**

Let say BMB1 9:30 is BMB1-1 and 14:30 BMB1-2 and so on

Variables: BMB1-1, BMB1-2, BMB2-1, BMB2-2, BMB3-1, BMB3-2

Domains: {CENG111, CENG213, CENG223, CENG315, CENG331 and CENG351}

Constraints:

1. (a,b) or (b,a) => {(x,y)} or {(y,x)} , if(a,b) = {( BMB1-1, BMB2-1), ( BMB2-2, BMB3-1)}} , then (x,y) cannot be { (CENG213, CENG223), (CENG315, CENG331), (CENG315, CENG351), (CENG331, CENG351)}
2. (a,b) => (x,y) , x≠y

**b.**

Let say CENG111 = 1, CENG213=2, CENG223=3, CENG315=4, CENG331=5 and CENG351=6

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3,4,5,6 | 4,5,6 | 4,5,6 | 3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3 | 4,5,6 | 4,5,6 | 4,5,6 |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3 | 4 | - | 5,6 |

Since 5 is 3th class course and 4 is at BMB2-2 There is no value to assign BMB3-1 so it is terminated here.

**c.**

Let say CENG111 = 1, CENG213=2, CENG223=3, CENG315=4, CENG331=5 and CENG351=6

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 | 1,2,3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 | 2,3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3,4,5,6 | 3,4,5,6 | 3,4,5,6 | 3,4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3 | 4,5,6 | 4,5,6 | 4,5,6 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BMB1-1 | BMB1-2 | BMB2-1 | BMB2-2 | BMB3-1 | BMB3-2 |
| 1 | 2 | 3 | 4 | - | 5,6 |

After setting BMB2-2 as 4 and comparing it with BMB3-1 we can see that it cannot be 5 or 6 so we remove them and after removing them there is not remaining any value of the Domains, so it terminates.

**2)**

|  |  |  |
| --- | --- | --- |
| V | α | β |
| A | -∞ | ∞ |
| B | -∞ | ∞ |
| D | -∞ | ∞ |
| D | 3 | ∞ |
| D | 5 | ∞ |
| B | -∞ | 5 |
| E | -∞ | 5 |
| E | 6 | 5 |
| Prune | Prune | Prune |
| B | 6 | 5 |
| A | 5 | ∞ |
| C | 5 | ∞ |
| F | 5 | ∞ |
| C | 5 | 2 |
| Prune | Prune | Prune |

**3)**

**a.**

To prove K ⇒ L with forward chaining I have created this table to count the values.

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 2 |
| E∧H⇒G | 2 |
| E∧F⇒H | 2 |
| G∧A⇒E | 2 |
| A∧B⇒E | 2 |
| B∧C⇒F | 2 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨A, B, C, D⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 2 |
| E∧H⇒G | 2 |
| E∧F⇒H | 2 |
| G∧A⇒E | 1 |
| A∧B⇒E | 1 |
| B∧C⇒F | 2 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨B, C, D⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 2 |
| E∧H⇒G | 2 |
| E∧F⇒H | 2 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 1 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨C, D, E⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 2 |
| E∧H⇒G | 2 |
| E∧F⇒H | 2 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨D, E, F⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 1 |
| E∧H⇒G | 2 |
| E∧F⇒H | 2 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨E, F⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 1 |
| E∧H⇒G | 1 |
| E∧F⇒H | 1 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨F⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 2 |
| H∧D⇒J | 1 |
| E∧H⇒G | 1 |
| E∧F⇒H | 0 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨H⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 1 |
| H∧D⇒J | 0 |
| E∧H⇒G | 0 |
| E∧F⇒H | 0 |
| G∧A⇒E | 1 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨G,J⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 2 |
| G∧H⇒I | 0 |
| H∧D⇒J | 0 |
| E∧H⇒G | 0 |
| E∧F⇒H | 0 |
| G∧A⇒E | 0 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨J,I⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 1 |
| G∧H⇒I | 0 |
| H∧D⇒J | 0 |
| E∧H⇒G | 0 |
| E∧F⇒H | 0 |
| G∧A⇒E | 0 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨I⟩

|  |  |
| --- | --- |
| c | Count(c) |
| I∧J⇒K | 0 |
| G∧H⇒I | 0 |
| H∧D⇒J | 0 |
| E∧H⇒G | 0 |
| E∧F⇒H | 0 |
| G∧A⇒E | 0 |
| A∧B⇒E | 0 |
| B∧C⇒F | 0 |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |

agenda = ⟨⟩

Since all the count values are 0 and i have reached K, we proved the K ⇒ L.

**b.**

To prove K ⇒ L with backward chaining

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| A∧B⇒E |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| **K ⇒ L** |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| A∧B⇒E |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| **I∧J⇒K** |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| A∧B⇒E |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| **G∧H⇒I** |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| A∧B⇒E |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| **E∧H⇒G** |
| E∧F⇒H |
| G∧A⇒E |
| A∧B⇒E |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| **E∧F⇒H** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| B∧C⇒F |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| E∧F⇒H |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| E∧H⇒G |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| G∧H⇒I |
| H∧D⇒J |
| **E∧H⇒G ✓** |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| **G∧H⇒I ✓** |
| H∧D⇒J |
| **E∧H⇒G ✓** |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| I∧J⇒K |
| **G∧H⇒I ✓** |
| **H∧D⇒J ✓** |
| **E∧H⇒G ✓** |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| K ⇒ L |
| **I∧J⇒K ✓** |
| **G∧H⇒I ✓** |
| **H∧D⇒J ✓** |
| **E∧H⇒G ✓** |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

|  |
| --- |
| **K ⇒ L ✓** |
| **I∧J⇒K ✓** |
| **G∧H⇒I ✓** |
| **H∧D⇒J ✓** |
| **E∧H⇒G ✓** |
| **E∧F⇒H ✓** |
| G∧A⇒E |
| **A∧B⇒E ✓** |
| **B∧C⇒F ✓** |
| A |
| B |
| C |
| D |

I showed all steps of backward chaining in the above tables and bolded the steps and put **✓** when its satisfied.