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CS5110 – Multi-Agent Systems

Project1

APPLICANT1.txt & EMPLOYERS1.txt

rylei@RMLaptop:~/Spring24/CS5110/Project1$ cd /home/rylei/Spring24/CS5110/Project1 ; /usr/bin/env /bin/python3 /home/rylei/.vscode/extensions/ms-python.python-2023.22.1/pythonFiles/lib/python/debugpy/adapter/../../debugpy/launcher 56193 -- /home/rylei/Spring24/CS5110/Project1/Graph.py

Vertices are:

['Source', 'A', 'B', 'C', 'D', 'E', 'F', 'a', 'b', 'c', 'd', 'e', 'f', 'Sink']

Edges are:

[(1, 7, 2, 1), (1, 8, 6, 1), (1, 10, 6, 1), (1, 11, 4, 1), (2, 8, 3, 1), (2, 11, 4, 1), (2, 12, 7, 1), (3, 9, 3, 1), (4, 10, 3, 1), (5, 8, 3, 1), (6, 7, 3, 1), (0, 1, 0, 1), (0, 2, 0, 1), (0, 3, 0, 1), (0, 4, 0, 1), (0, 5, 0, 1), (0, 6, 0, 1), (7, 13, 0, 1), (8, 13, 0, 1), (9, 13, 0, 1), (10, 13, 0, 1), (11, 13, 0, 1), (12, 13, 0, 1)]

adjacency

 0: 0 1 1 1 1 1 1 0 0 0 0 0 0 0

 1: 0 0 0 0 0 0 0 1 1 0 1 1 0 0

 2: 0 0 0 0 0 0 0 0 1 0 0 1 1 0

 3: 0 0 0 0 0 0 0 0 0 1 0 0 0 0

 4: 0 0 0 0 0 0 0 0 0 0 1 0 0 0

 5: 0 0 0 0 0 0 0 0 1 0 0 0 0 0

 6: 0 0 0 0 0 0 0 1 0 0 0 0 0 0

 7: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

 8: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

 9: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

10: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

11: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

12: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

13: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

residual

 0: 0 1 1 1 1 1 1 0 0 0 0 0 0 0

 1: 0 0 0 0 0 0 0 1 1 0 1 1 0 0

 2: 0 0 0 0 0 0 0 0 1 0 0 1 1 0

3: 0 0 0 0 0 0 0 0 0 1 0 0 0 0

4: 0 0 0 0 0 0 0 0 0 0 1 0 0 0

5: 0 0 0 0 0 0 0 0 1 0 0 0 0 0

6: 0 0 0 0 0 0 0 1 0 0 0 0 0 0

7: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

8: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

9: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

10: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

11: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

12: 0 0 0 0 0 0 0 0 0 0 0 0 0 1

13: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

cost

0: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

1: 0 0 0 0 0 0 0 2 6 0 6 4 0 0

2: 0 0 0 0 0 0 0 0 3 0 0 4 7 0

3: 0 0 0 0 0 0 0 0 0 3 0 0 0 0

4: 0 0 0 0 0 0 0 0 0 0 3 0 0 0

5: 0 0 0 0 0 0 0 0 3 0 0 0 0 0

6: 0 0 0 0 0 0 0 3 0 0 0 0 0 0

7: 0 -2 0 0 0 0 -3 0 0 0 0 0 0 0

8: 0 -6 -3 0 0 -3 0 0 0 0 0 0 0 0

9: 0 0 0 -3 0 0 0 0 0 0 0 0 0 0

10: 0 -6 0 0 -3 0 0 0 0 0 0 0 0 0

11: 0 -4 -4 0 0 0 0 0 0 0 0 0 0 0

12: 0 0 -7 0 0 0 0 0 0 0 0 0 0 0

13: 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Stable Matching with Applicants Proposing:

{'A': None, 'B': 'c', 'C': 'd', 'D': None, 'E': 'b', 'F': 'a'}

Stable Matching with Employers Proposing: {'a': 'A', 'b': 'B', 'c': 'C', 'd': None, 'e': None, 'f': 'D'}

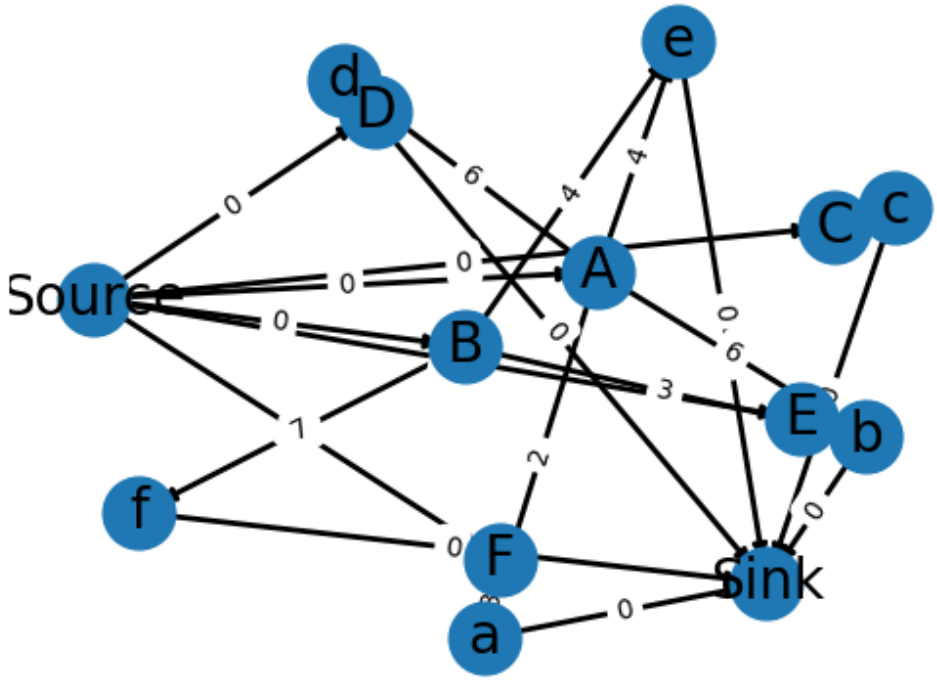
{'a': 'A', 'b': 'B', 'c': 'C', 'd': None, 'e': None, 'f': 'D'}

applicants preferences: {'A': ['e', 'b', 'd'], 'B': ['b', 'e', 'f'], 'C': ['c'], 'D': ['d'], 'E': ['c'], 'F': ['e', 'c']}

employers preferences: {'a': ['F'], 'b': ['E', 'A'], 'c': ['D'], 'd': ['A'], 'e': [], 'f': ['A', 'B', 'C', 'E', 'F']}

Results for ('Applicants1.txt', 'Employers1.txt'): Total Flow = 6, Total Cost = 23

SEE app1Emp1.png



App1Emp1.png

APPLICANTS2 & EMPLOYERS2.TXT

rylei@RMLaptop:~/Spring24/CS5110/Project1$ cd /home/rylei/Spring24/CS5110/Project1 ; /usr/bin/env /bin/python3 /home/rylei/.vscode/extensions/ms-python.python-2023.22.1/pythonFiles/lib/python/debugpy/adapter/../../debugpy/launcher 50169 -- /home/rylei/Spring24/CS5110/Project1/Graph2.py

Vertices are:

['Source', 'W', 'X', 'V', '', 'a', 'b', 'c', 'Sink']

Edges are:

[(3, 5, 5, 1), (3, 6, 4, 1), (1, 5, 4, 1), (1, 6, 2, 1), (1, 7, 4, 1), (2, 5, 4, 1), (2, 6, 3, 1), (2, 7, 4, 1), (0, 1, 0, 1), (0, 2, 0, 1), (0, 3, 0, 1), (0, 4, 0, 1), (5, 8, 0, 1), (6, 8, 0, 1), (7, 8, 0, 1)]

adjacency

0: 0 1 1 1 1 0 0 0 0

1: 0 0 0 0 0 1 1 1 0

2: 0 0 0 0 0 1 1 1 0

3: 0 0 0 0 0 1 1 0 0

4: 0 0 0 0 0 0 0 0 0

5: 0 0 0 0 0 0 0 0 1

6: 0 0 0 0 0 0 0 0 1

7: 0 0 0 0 0 0 0 0 1

8: 0 0 0 0 0 0 0 0 0

residual

0: 0 1 1 1 1 0 0 0 0

1: 0 0 0 0 0 1 1 1 0

2: 0 0 0 0 0 1 1 1 0

3: 0 0 0 0 0 1 1 0 0

4: 0 0 0 0 0 0 0 0 0

5: 0 0 0 0 0 0 0 0 1

6: 0 0 0 0 0 0 0 0 1

7: 0 0 0 0 0 0 0 0 1

8: 0 0 0 0 0 0 0 0 0

cost

0: 0 0 0 0 0 0 0 0 0

1: 0 0 0 0 0 4 2 4 0

2: 0 0 0 0 0 4 3 4 0

3: 0 0 0 0 0 5 4 0 0

4: 0 0 0 0 0 0 0 0 0

5: 0 -4 -4 -5 0 0 0 0 0

6: 0 -2 -3 -4 0 0 0 0 0

7: 0 -4 -4 0 0 0 0 0 0

8: 0 0 0 0 0 0 0 0 0

Stable Matching with Applicants Proposing:

{'W': 'b', 'X': None, 'V': None}

Stable Matching with Employers Proposing: {'a': 'X', 'b': 'W', 'c': 'V'}

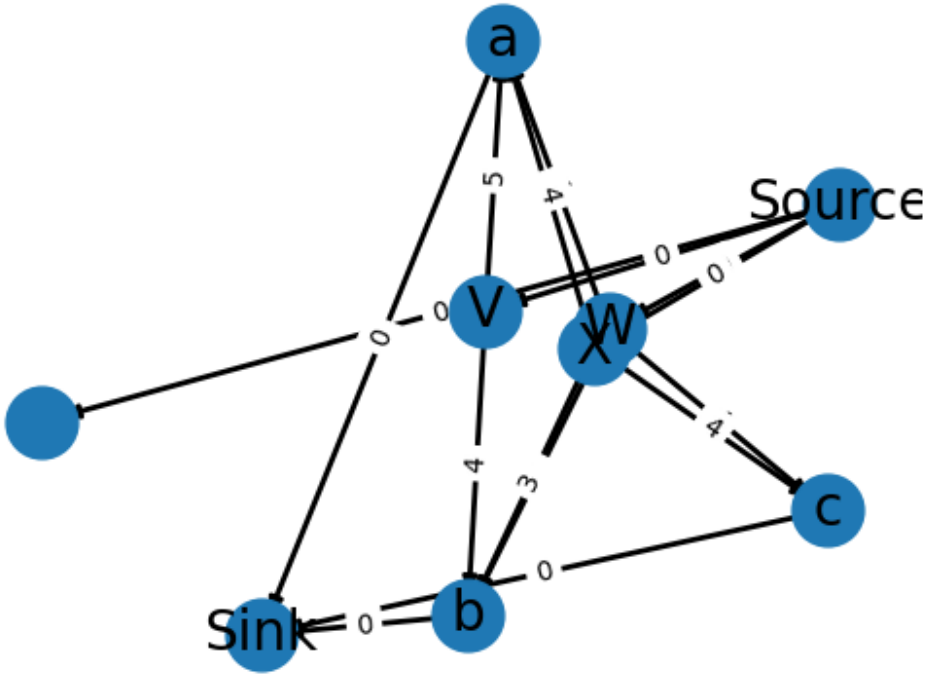
{'a': 'X', 'b': 'W', 'c': 'V'}

applicants preferences: {'W': ['c', 'a'], 'X': ['a', 'c'], 'V': ['a']}

employers preferences: {'a': ['V'], 'b': ['X', 'V'], 'c': []}

Results for ('Applicants2.txt', 'Employers2.txt'): Total Flow = 3, Total Cost = 11

SEE App2Emp2.png



App2Emp2.png

MYAPPLICANTS1 & MYAPPLICANTS2

rylei@RMLaptop:~/Spring24/CS5110/Project1$ cd /home/rylei/Spring24/CS5110/Project1 ; /usr/bin/env /bin/python3 /home/rylei/.vscode/extensions/ms-python.python-2023.22.1/pythonFiles/lib/python/debugpy/adapter/../../debugpy/launcher 60487 -- /home/rylei/Spring24/CS5110/Project1/MyGraph.py

Vertices are:

['Source', 'A', 'B', 'C', 'D', 'E', 'f', 'g', 'h', 'i', 'j', 'Sink']

Edges are:

[(1, 6, 3, 1), (1, 7, 6, 1), (1, 8, 6, 1), (1, 9, 6, 1), (1, 10, 6, 1), (2, 6, 5, 1), (2, 7, 5, 1), (2, 8, 8, 1), (2, 9, 4, 1), (2, 10, 3, 1), (3, 6, 8, 1), (3, 7, 6, 1), (3, 8, 6, 1), (3, 9, 9, 1), (3, 10, 4, 1), (4, 6, 9, 1), (4, 7, 5, 1), (4, 8, 9, 1), (4, 9, 5, 1), (4, 10, 6, 1), (5, 6, 7, 1), (5, 7, 7, 1), (5, 8, 2, 1), (5, 9, 5, 1), (5, 10, 10, 1), (0, 1, 0, 1), (0, 2, 0, 1), (0, 3, 0, 1), (0, 4, 0, 1), (0, 5, 0, 1), (6, 11, 0, 1), (7, 11, 0, 1), (8, 11, 0, 1), (9, 11, 0, 1), (10, 11, 0, 1)]

adjacency

 0: 0 1 1 1 1 1 0 0 0 0 0 0

 1: 0 0 0 0 0 0 1 1 1 1 1 0

 2: 0 0 0 0 0 0 1 1 1 1 1 0

 3: 0 0 0 0 0 0 1 1 1 1 1 0

 4: 0 0 0 0 0 0 1 1 1 1 1 0

 5: 0 0 0 0 0 0 1 1 1 1 1 0

 6: 0 0 0 0 0 0 0 0 0 0 0 1

 7: 0 0 0 0 0 0 0 0 0 0 0 1

 8: 0 0 0 0 0 0 0 0 0 0 0 1

 9: 0 0 0 0 0 0 0 0 0 0 0 1

10: 0 0 0 0 0 0 0 0 0 0 0 1

11: 0 0 0 0 0 0 0 0 0 0 0 0

residual

 0: 0 1 1 1 1 1 0 0 0 0 0 0

 1: 0 0 0 0 0 0 1 1 1 1 1 0

 2: 0 0 0 0 0 0 1 1 1 1 1 0

 3: 0 0 0 0 0 0 1 1 1 1 1 0

 4: 0 0 0 0 0 0 1 1 1 1 1 0

5: 0 0 0 0 0 0 1 1 1 1 1 0

6: 0 0 0 0 0 0 0 0 0 0 0 1

7: 0 0 0 0 0 0 0 0 0 0 0 1

8: 0 0 0 0 0 0 0 0 0 0 0 1

9: 0 0 0 0 0 0 0 0 0 0 0 1

10: 0 0 0 0 0 0 0 0 0 0 0 1

11: 0 0 0 0 0 0 0 0 0 0 0 0

cost

0: 0 0 0 0 0 0 0 0 0 0 0 0

1: 0 0 0 0 0 0 3 6 6 6 6 0

2: 0 0 0 0 0 0 5 5 8 4 3 0

3: 0 0 0 0 0 0 8 6 6 9 4 0

4: 0 0 0 0 0 0 9 5 9 5 6 0

5: 0 0 0 0 0 0 7 7 2 5 10 0

6: 0 -3 -5 -8 -9 -7 0 0 0 0 0 0

7: 0 -6 -5 -6 -5 -7 0 0 0 0 0 0

8: 0 -6 -8 -6 -9 -2 0 0 0 0 0 0

9: 0 -6 -4 -9 -5 -5 0 0 0 0 0 0

10: 0 -6 -3 -4 -6 -10 0 0 0 0 0 0

11: 0 0 0 0 0 0 0 0 0 0 0 0

Stable Matching with Applicants Proposing:

{'A': 'f', 'B': 'j', 'C': None, 'D': 'i', 'E': 'h'}

Stable Matching with Employers Proposing: {'f': 'A', 'g': 'C', 'h': 'E', 'i': 'D', 'j': 'B'}

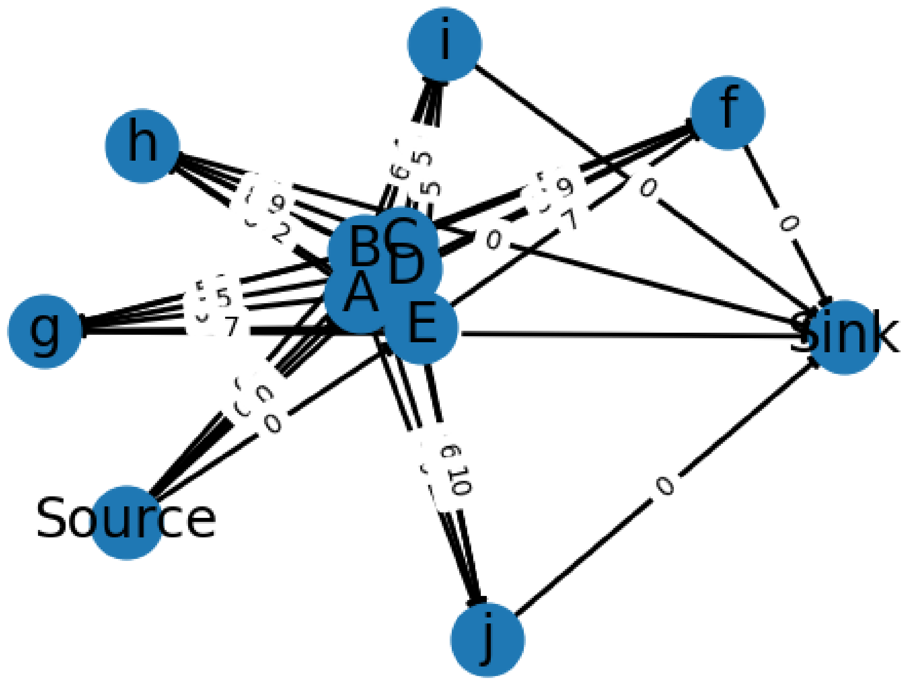
{'f': 'A', 'g': 'C', 'h': 'E', 'i': 'D', 'j': 'B'}

applicants preferences: {'A': ['g', 'i', 'h', 'j'], 'B': ['g', 'i', 'f', 'h'], 'C': ['h', 'f', 'i', 'g'], 'D': ['j', 'g', 'h', 'f'], 'E': ['g', 'i', 'f', 'j']}

employers preferences: {'f': ['E', 'D', 'C'], 'g': ['D', 'B', 'A', 'E'], 'h': ['A', 'B', 'C', 'D'], 'i': ['C'], 'j': ['C', 'D', 'E']}

Results for ('MyApplicants1.txt', 'MyEmployers1.txt'): Total Flow = 5, Total Cost = 18

SEE MyApp1MyEmp1.png



MyApp1MyEmp1.png

Additional Info:

Process:

- Parsing
- Implemented stable matching (employers proposing & applicants) and min-cost max-flow
- Comparisons
- Min capacity (max flow)
- Augment flow (max flow)
- Path cost (max flow)
- Bellman to path/fix
- Ford-Fulkerson for flow
- Calculate flow
- Create graphs (with imports)

Issues:

When I was developing the program, I could not get it to print my outputs. After a lot of confusing and debugging, I figured out that it was because I had created an Infinet loop, and the program was stuck inside of it.

My computer began to struggle running all the code because I was fixing very small things and rerunning. This caused the terminal to lag and get very backed up. I had to restart VSCode.

Note: Imports used in this assignment were used for creating the images only.