Florida Institute of Technology

CSE 3231

Fall 2024

Class Project – Final

Total points: 150 points

Professor:
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1. Project Description

The purpose of this project is to write a program that will simulate the functions of standard routing algorithms in computer networks. The simulation will be limited to the state of information maintained at each node in time. Only the distance vector (Bellman Ford) algorithm will be simulated, following the process illustrated in class, but a single shortest path calculation for each node for the input graph will also be performed, as ground truth.

2. Inputs

A network topology will be used as input to your application. The topology will be represented as a graph, with each router ID receiving an alphabetic label as identifier. Please note that time stamps are provided as part of the file to illustrate changes in topology, and time, in this context, refers to your simulation step. All the information required will be provided as a single text file. An example input file, and corresponding diagram (for illustration only) is provided with the assignment.

3. Stop condition

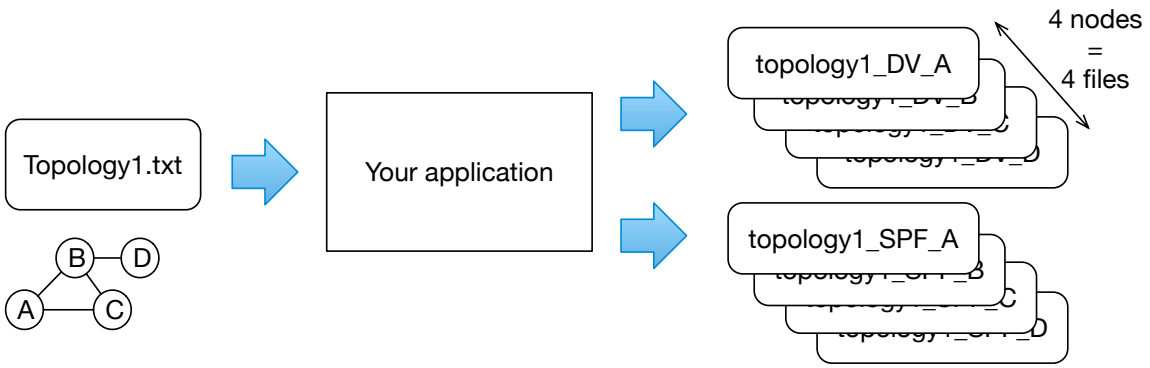
The application should end and complete the simulation (i.e. finalize the output files) when the routing tables on all nodes in the network have remained stable for 5 consecutive iterations, or if a total of 100 simulation steps has been reached, regardless of the internal state of routing tables at each router.

4. Output

The output of your application may include console information if helpful but **must** include a text file containing the ground truth tables calculated (using Dijkstra) for each node, and a text file containing a step-by-step evolution of state of all routers in the network. The information requested for the specific state information for each router will be detailed in the example provided with the assignment. Please note that the state information requested for this assignment is a simplified set of the actual state used in actual routing protocols and omits several pieces of information included in actual protocols. Make sure the output of your project is provided a single text file for each approach, strictly following the naming convention and output format.

5. Naming Convention

Your application will receive as in put a text file with an arbitrary name, following the format (<filename>.txt), and will generate a text file (<filename>_SPF_N.txt) for ground truth shortest path first (SPF) information for each node (N) using the Dijkstra algorithm. This calculation only happens once for each node, using the ground trough graph. Another set of files created by your program will be the distance vector output file (DV) (<filename>_DV_N.txt). This file will contain the internal state of each node during each step of the simulation running the DV algorithm.



6. Discreate time simulation

The simulation may be implemented sequentially, with each node in the network (in some order defined by you) acting on a given time step. Please note, however, that all nodes take one action during a given time step. Please maintain state transitions/updates and message exchanges on separate time steps. For example, all nodes transmit and receive messages from their neighbors in a single time step, updating their states in the next time step, based on the information received.

7. Code Deliverable

The full source code of your assignment must be provided as one of the project deliverables (see item 5). You are free to use any programming language you like, but please note that I must be able to run your code with other test cases that will be used for evaluation. You are responsible for providing clear instructions on how to unpack, prepare, and run your code, and that will constitute part of your grading.

8. Project Deliverables

Grading will be based on the evaluation of ALL items required as deliverables.

- One page summary of the work performed, including running instructions and names of participants, with contributions noted for each participant (groups only).
- Documented source code.
- Output files for each of the example input files provided.

Please ensure that all items are submitted together as a single compressed file (zip file) via canvas no later than 12/03 by midnight. Extensions will not be possible, so please plan accordingly.

9. Project Deadlines

- 11/14 – Identify groups (if applicable), and presentation schedule.
- 12/3 – Projects due by end of day (no class)
- 12/5 – Projects Presentations

10. Example

10.1. Input File

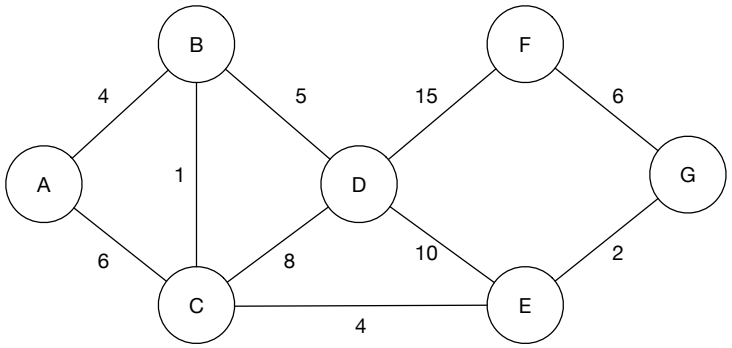
Input file (topology1.txt):

(this is the input file)

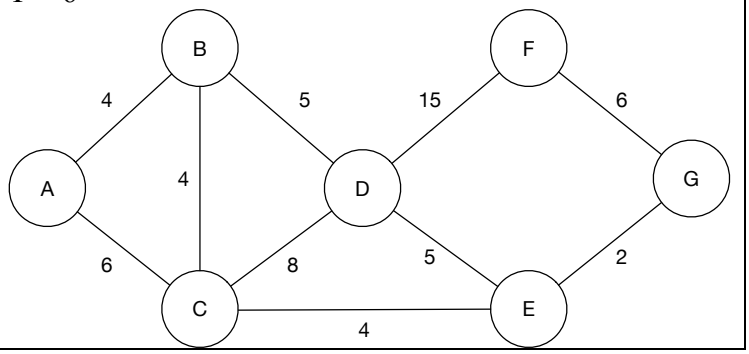
```
0: A, B, 4
0: A, C, 6
0: B, C, 1
0: C, D, 8
0: C, E, 4
0: D, E, 10
0: D, F, 15
0: E, G, 2
0: E, G, 2
0: F, G, 6
6: E, D, 5
6: F, G, 6
```

(for visualization only)

T = 0



T = 6



10.2. Input File (DV)

Output File for Node A: (topology1_DV_A.txt)

0	**A**	**A**	**0**	**|**	**0**	**N**	**N**	**N**	**N**	**N**	**N**
0	B	N	N	|	N	N	N	N	N	N	N
0	C	N	N	|	N	N	N	N	N	N	N
0	D	N	N	|	N	N	N	N	N	N	N
0	E	N	N	|	N	N	N	N	N	N	N
0	F	N	N	|	N	N	N	N	N	N	N
0	G	N	N	|	N	N	N	N	N	N	N
1	**A**	**A**	**0**	**|**	**0**	**N**	**N**	**N**	**N**	**N**	**N**
1	B	N	N	|	N	0	N	N	N	N	N
1	C	N	N	|	N	N	0	N	N	N	N
1	D	N	N	|	N	N	N	N	N	N	N
1	E	N	N	|	N	N	N	N	N	N	N
1	F	N	N	|	N	N	N	N	N	N	N
1	G	N	N	|	N	N	N	N	N	N	N
2	**A**	**A**	**0**	**|**	**0**	**4**	**6**	**N**	**N**	**N**	**N**
2	B	B	4	|	N	0	N	N	N	N	N
2	C	C	6	|	N	N	0	N	N	N	N
2	D	N	N	|	N	N	N	N	N	N	N
2	E	N	N	|	N	N	N	N	N	N	N
2	F	N	N	|	N	N	N	N	N	N	N
2	G	N	N	|	N	N	N	N	N	N	N
3	**A**	**A**	**0**	**|**	**0**	**4**	**6**	**N**	**N**	**N**	**N**
3	B	B	4	|	4	0	1	5	N	N	N
3	C	C	6	|	6	1	0	8	4	N	N
3	D	N	N	|	N	N	N	N	N	N	N
3	E	N	N	|	N	N	N	N	N	N	N
3	F	N	N	|	N	N	N	N	N	N	N
3	G	N	N	|	N	N	N	N	N	N	N
4	**A**	**A**	**0**	**|**	**0**	**4**	**6**	**N**	**N**	**N**	**N**
4	B	B	4	|	4	0	1	5	N	N	N
4	C	B	5	|	6	1	0	8	4	N	N
4	D	B	9	|	N	N	N	N	N	N	N
4	E	B	9	|	N	N	N	N	N	N	N
4	F	N	N	|	N	N	N	N	N	N	N
4	G	N	N	|	N	N	N	N	N	N	N

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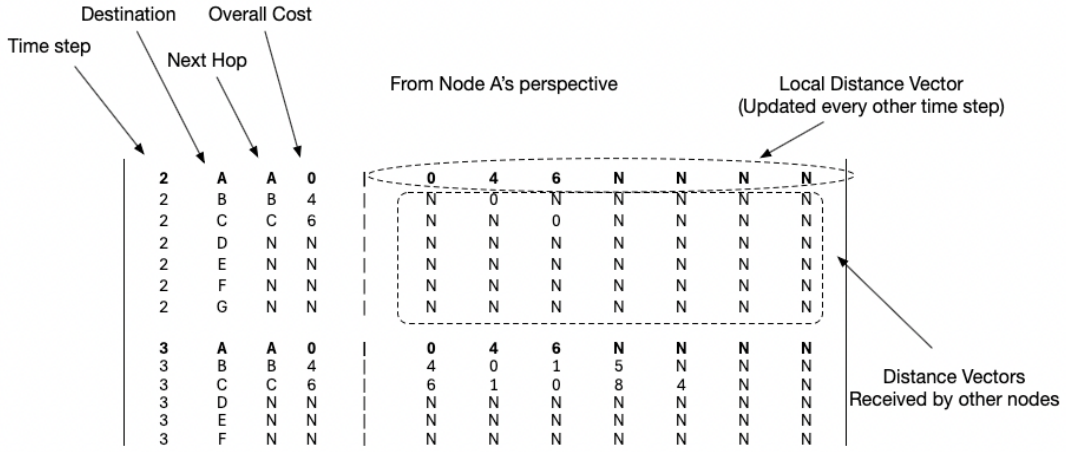

10.3. Input File (SPF)

Output File for Node A: (topology1_SPF_A.txt)

0	|	A	0	A
0	|	B	4	B
0	|	C	5	B, C
0	|	D	9	B, D
0	|	E	9	B, C, E
0	|	G	11	B, C, E, G
0	|	F	17	B, C, E, G, F
6	|	A	0	A
6	|	B	4	B
6	|	C	6	C
6	|	D	9	B, D
6	|	E	10	C, E
6	|	G	12	C, E, G
6	|	F	18	C, E, G