Programming Assignment 2: Link State Routing

Due Date: 28 Oct 2016, 11:59 pm

Marks: 10 marks + 1 bonus for early submission (by 21 Oct)

Marking Guide:

The following shows the sequence of events that will be involved in the testing of the assignment:

Initialisation

1) You have to mark the assignments for the students within your lab, manually (running the programs and comparing the outputs). This is an individual assignment.
2) Please mark on a CSE machine (via ssh) and NOT on your personal computer.
3) Please use the attached marking sheet, print one for each student and note down his or her marks. Please also enter comments for any marks you are deducting in SMS.
4) Open a terminal window and ensure that the working directory contains the assignment files for the student.
5) First compile the files.

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>> javac *.java or
>> gcc -o Lsr -c Lsr.c
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If the students have submitted other helper files or classes, they must have also submitted a makefile in which case just run the makefile (for C). The executable file must be named Lsr. For java programs just compile all files using javac *.java.

Please use the provided scripts to initiate the tests (please check permissions of the script files). You may need to change port #s if you get a message that the ports are in use.

Test 1 (CSE: 1.5 Marks, Non-CSE: 2.4 Marks) Simple 3 Node Topology

The first test topology is a simple one as follows:

![Simple 3 Node Topology](image)

Step 1: Use the provided script to run the test. It should initiate 3 terminal windows, one window per node.

Step 2: Wait for about a minute for the output to appear in the xterm window for each node. The output should read as follows:
At node A:

Shortest path to node B: ACB and the cost is 5
Shortest path to node C: AC and the cost is 2

At node B:

Shortest path to node A: BCA and the cost is 5
Shortest path to node C: BC and the cost is 3

At node C:

Shortest path to node A: CA and the cost is 2
Shortest path to node B: CB and the cost is 3

Wait for an additional minute to make sure that the output does appear. The outputs may not appear synchronously, which is fine. They do not necessarily have to print the output in alphabetical order. Their code may print additional output which is fine.

Kill each node by typing CTRL-C.

CSE Marking: 0.125 mark for each correct shortest path and 0.125 mark for each correct cost in the above. Hence each entry is worth 0.25 mark in total and the total marks for each node output are 0.5 (3 nodes x 0.5 marks each = 1.5 marks).

Non-CSE Marking: 0.2 mark for each correct shortest path and 0.2 mark for each correct cost in the above. Hence each entry is worth 0.4 mark in total and the total marks for each node output are 0.8 (3 nodes x 0.8 marks each = 2.4 marks).

Test 2 (CSE: 4 marks, Non-CSE: 5.6 marks) Complex Topology Test

Step 1: Use the provided script to run the test. It should initiate 6 terminal windows, one window per node. Here is the topology being tested:

![Topology Diagram]

NOTE: If these port numbers are in use you can use different port numbers but then you will need to change the config files accordingly.

Step 2: Wait for at least 2 minutes for the output to appear in the xterm window for each node. The output should read as follows:
At node P:

Shortest path to node Q: PQ and the cost is 1
Shortest path to node R: PR and the cost is 2
Shortest path to node S: PRS and the cost is 3
Shortest path to node T: PQUT and the cost is 6
Shortest path to node U: PQU and the cost is 5

At node Q:

Shortest path to node P: QP and the cost is 1
Shortest path to node R: QPR and the cost is 3
Shortest path to node S: QPRS and the cost is 4
Shortest path to node T: QUT and the cost is 5
Shortest path to node U: QU and the cost is 4

At node R:

Shortest path to node P: RP and the cost is 2
Shortest path to node Q: RPQ and the cost is 3
Shortest path to node S: RS and the cost is 1
Shortest path to node T: RST and the cost is 5
Shortest path to node U: RSTU and the cost is 6

At node S:

Shortest path to node P: SRP and the cost is 3
Shortest path to node Q: SRPQ and the cost is 4
Shortest path to node R: SR and the cost is 1
Shortest path to node T: ST and the cost is 4
Shortest path to node U: STU and the cost is 5

At node T:

Shortest path to node P: TUQP and the cost is 6
Shortest path to node Q: TUQ and the cost is 5
Shortest path to node R: TSR and the cost is 5
Shortest path to node S: TS and the cost is 4
Shortest path to node U: TU and the cost is 1

At node U:

Shortest path to node P: UQP and the cost is 5
Shortest path to node Q: UQ and the cost is 4
Shortest path to node R: UTSR and the cost is 6
Shortest path to node S: UTS and the cost is 5
Shortest path to node T: UT and the cost is 1

Wait for an additional minute to make sure that the output does appear. The outputs may not appear synchronously, which is fine. They do not necessarily have to print the output.
in alphabetical order. Their code may print additional output which is fine. Keep the nodes alive for the next test.

CSE Marking: 0.067 mark for each correct shortest path and 0.067 mark for each correct cost in the above. Hence each entry is worth 0.133 mark in total and the total marks for each node output are 0.667 (6 nodes x 2/3 marks each = 4 marks).

Non-CSE Marking: 0.093 mark for each correct shortest path and 0.093 mark for each correct cost in the above. Hence each entry is worth 0.186 mark in total and the total marks for each node output are 0.933 (6 nodes x 0.933 marks each = 5.6 marks).

Test 3 (CSE: 2.5 marks Non-CSE: NOT MARKED) Handling failed nodes

ONLY KILL NODE R by typing CTRL-C in its terminal window. Ignore the first output that is printed immediately after the node failure. Wait for the next output. In fact, to be on the safe side wait for one more output (i.e. 1 minute). Note that each node will reprint the output every 30 seconds.

The output should read as follows:

At node P:

Shortest path to node Q: PQ and the cost is 1
Shortest path to node S: PS and the cost is 5
Shortest path to node T: PQUT and the cost is 6
Shortest path to node U: PQU and the cost is 5

At node Q:

Shortest path to node P: QP and the cost is 1
Shortest path to node S: QPS and the cost is 6
Shortest path to node T: QUT and the cost is 5
Shortest path to node U: QU and the cost is 4

At node S:

Shortest path to node P: SP and the cost is 5
Shortest path to node Q: SPQ and the cost is 6
Shortest path to node T: ST and the cost is 4
Shortest path to node U: STU and the cost is 5

At node T:

Shortest path to node P: TUQP and the cost is 6
Shortest path to node Q: TUQ and the cost is 5
Shortest path to node S: TS and the cost is 4
Shortest path to node U: TU and the cost is 1

At node U:

Shortest path to node P: UQP and the cost is 5
Shortest path to node Q: UQ and the cost is 4
Shortest path to node S: UTS and the cost is 5
Shortest path to node T: UT and the cost is 1

Marking: The entries that are affected due to the failure of node R are indicated in italics in the above output. 0.5 mark should be assigned for each of these correct entries (there are 4 of them): 0.25 mark for each correct path and 0.25 mark for each correct cost in the above. Since there are 4 such entries this amounts to 2 marks in total. Allocate 0.5 mark if rest of the entries are not changed.

Now kill all the nodes by typing CTRL-C.

Test 4 (All students: 2 marks) Report + Mechanism to Restrict Link-state Broadcasts

Students were asked to implement a mechanism to restrict the # of link-state messages. This part is open-ended. You will need to read their report to find out how they have accomplished this. Make sure you review their code to check if they have implemented such a mechanism. As long as they have implemented some method assign them 1 mark.

The students will also submit a 3-page report (report.pdf), which describes how they have implemented their program. It must also discuss about future extensions and means to realise these extensions. Please quickly browse through the code to ensure that this description corresponds with their actual code (students may otherwise simply copy someone else’s report). As long as they have a reasonable write-up assign them 1 mark.

Early Submission Bonus (not for non-CSE students)

Check if the submission was received by 2:00 am on Saturday, 22nd October. This includes a 2 hour grace period. If so and ONLY IF they have scored 7 marks or more on the above tests, should the 1 mark bonus be awarded.

Late Submission Penalty

If the submission is few hours late (i.e 3 hours) after the deadline, please do not penalize it. For other late submissions proceed as follows:

- 1 day after deadline : 10% reduction
- 2 days after deadline : 20% reduction
- 3 days after deadline : 30% reduction
- 4 days after deadline : 40% reduction
- 5 or more days late : NOT accepted

NOTE: You will have to manually deduct the penalty and add the bonus.