###### *CSE 473 – Introduction to Computer Networks Jon Turner*

Lab 5 Report

##### *Your name: 11/21/2013*

***Part A***. (20 points)Paste a copy of the completed source code for the *Forwarder* class below. Highlight your changes by making them **bold**(you may omit sections of the original program that contain no added code). Remember to also place a complete copy in the repository before you make your final commit. *Your* committed version should have no extraneous *print* statements.

your code here

***Part B***. (30 points)Paste a copy of the completed source code for the *Router* class below. Highlight your changes by making them **bold**(you may omit sections of the original program that contain no added code). Remember to also place a complete copy in the repository before you make your final commit. *Your* committed version should have no extraneous *print* statements.

your code here

***Part C****.* Put your files for this lab in the directory ~/473/lab5. In this part, you will be running some tests using the configuration and script you will find in the *net1* sub-directory.

1. (5 points) Draw a diagram showing the logical links joining the three routers in the overlay network defined by the configuration files *r1*, *r2* and *r3*. Label the inter-router links with their assigned link costs.

*your diagram here*

1. (5 points) Run *script1* in the *net1* sub-directory by typing

./script1 .333 20 static

Paste a copy of the output below.

your output here

1. (5 points) For each pair of routers *ri* and *rj*, write down the shortest path from *ri* to *rj* and the total cost of that path. Verify that the final routing tables and forwarding tables printed by *script1* are consistent with these shortest paths.
2. (5 points) Paste a screenshot of the monitoring window from your *script1* run below.

*your screenshot here*

Note how the bandwidth on some links changes part way through the run. Explain why this happens. How are packets routed during the first few seconds of the run? Why does this happen?

1. (5 points) How many packets per second should be sent on the link from *onl* router port 1.1 to *onl* router port 2.0 during the first part of the run? Your answer should include all packets sent by the routing algorithm and all packets sent by the *SrcSnk* that would travel over this link. Explain your answer. Does your answer match the observed packet rates?
2. (5 points) How many packets per second should be sent on the link from the *onl* router port 1.1 to onl router port 2.0 during the second part of the run? Explain your answer. Does your answer match the observed packet rates
3. (5 points) Run *script1* again by typing

./script1 .333 20 static debugg

and paste a copy of the resulting *log2* file below. Add comments to the output in bold to explain how the advertisements trigger changes in the routing table. Also, explain why some received advertisements do not trigger changes to the routing table.

your output here

1. (15 points) In this part, you will disable and re-enable one of the links while *script1* is running. This is done using a filter that is installed on *onl* router port 1.1. Click on this port in the RLI and select “Filter Table” from the menu. This will show you a “delete filter” which causes all packets received on this link to be discarded. At the right end of the filter table entry you will see a check box. Click on the check box and select “Commit” from the file menu in order to turn on the filter (effectively disabling the link). To turn off the filter (and re-enable the link), uncheck the box and select “Commit” again.

Now, run *script1* again (with the filter turned off) by typing

script1 .333 100 static debug

after the script has run for about 30 seconds, turn on the filter. Then wait another 30 seconds and turn off the filter. Paste a copy of the *log2* file from your run below and add comments in bold, explaining all changes to the routing table at *r1*.

your output here

Paste a screenshot of the monitoring window from your run below.

*your screenshot here*

Explain the packet rates leaving ONL router port 1.1 and 2.0 during the period when the link is disabled. Justify the specific numerical values observed.

***Part D***. In this part, you will be using the configuration in the *net2* subdirectory.

1. (10 points) Using the information in the provided configuration files draw a network graph that represents this network. Each node in the graph should be labeled with the router number (e.g. *r*1, *r*2, ...) and the last two components of the IP address of its ONL host (so, for example, *r*1 runs on the host whose address is 192.168.6.1, so label its node in the graph as with “*r*1/6.1”). Each link should be labeled with its cost and for each router, the endpoints of the links incident to it should be labeled 0, 1, 2,... where these local link numbers are determined by the order in which the neighbors are listed in the configuration file. For example, here is the relevant section from the configuration file for *r*1.

neighbor: 1.3.0.1 192.168.2.5 .03

neighbor: 1.6.0.1 192.168.5.2 .05

neighbor: 1.9.0.1 192.168.1.1 .04

The link connecting to *r*3 (which has IP address 1.3.0.1 in the overlay) would have an index of 0 at *r*1. The link connecting to *r*6 (which has IP address 1.6.0.1 in the overlay) would have an index of 1 at *r*1. The link connecting to *r*9 (which has IP address 1..0.1 in the overlay) would have an index of 2 at *r*1.

Find a shortest path tree in your network graph, rooted at router 2. Show the edges in the shortest path tree using heavy weight lines.

*your diagram here*

1. (10 points) Run the provided *script2* by typing

script2 .01 20 static

Paste a screenshot of the monitoring window from your run here.

*your screenshot here*

Paste the portion of the output from *log2* showing the final routing table at *r*2.

your table here

Do the routes in your routing table match the shortest path tree in your network graph? If not, explain why not.

1. (10 points) Run *script2* by typing

script2 .01 20 static debugg

Show all advertisements for prefix 1.7.0.0/\* that are *received* by r5 during the first round of advertisements (the ones that occur at around 10 seconds).

your output here

Which of *r*5’s neighbors send it advertisements for this prefix? Why do these neighbors send ads and the others do not? Do your best to explain your observations based on the delays that ads will experience as they pass through the network.

1. (10 points) Run *script2* by typing

script2 .01 120 debug

Paste a screenshot of the monitoring window below. To get the entire run on the display, you will need to zoom out, by clicking repeatedly on the arrow head at the right end of the horizontal axis.

*your screenshot here*

Type the command

grep "1.1.0.0.16....." log\*

and paste the results below. Remove all lines that are *identical* to the one above them. Highlight all the places after time 10, where the paths defined by the route change, by making them bold.

your output here

Paste a copy of your network graph below and highlight the shortest path tree defined by the routes going to *r*1 at time 15, by making the links heavy weight.

*your diagram here*

Find a time when the shortest path tree to *r*1 differs from the one at time 15. Paste another copy of your network graph below and highlight the links in the shortest path tree at that time. During what time period is this shortest path tree used?

*The shortest path tree shown below is used from time \_\_\_\_\_\_ to time \_\_\_\_\_\_.*

*your diagram here*