Homework #3
Due Date: November 8, 2016 (Tuesday) before class on CANVAS
Reading – Chapter 4 from textbook
Instructions – Homeworks must be submitted as a PDF file preferably typed. Scanned, handwritten versions are acceptable so long as the handwriting is legible. Sorry, we are unable to take extra effort to understand your handwriting.

Question 1
Suppose a network N within a larger organization A acquires its own direct connection to an Internet Service Provider, in addition to an existing connection via A. Let R1 be the router connecting N to its own provider, and let R2 be the router connecting N to the rest of A.
   a) Assuming N remains a subnet of A, how should R1 and R2 be configured? What limitations would still exist with N’s use of its separate connection? Would A be prevented from Using N’s connection? Specify your configuration in terms of what R1 and R2 should advertise, and with what paths. Assume a BGP like mechanism is available.
   b) Now suppose N gets its own network number; how does this change your answer in (a)?
   c) Describe a router configuration that would allow A to use N’s link when its own link is down.

Question 2
Let A be the number of autonomous systems on the Internet, and let D be the maximum AS path length. Suppose that you are able to organize the connectivity of the autonomous system in any manner that you want to (for example, in the form of a ring or a grid or a tree etc.).
   a) Give a connectivity model for which D is of the order of \( \log_2 A \) and another for which D is of the order of \( \sqrt{A} \).
   b) Assuming each AS number is 2 bytes and each network number is 4 bytes, given an estimate for the amount of data a BGP speaker must receive to keep track of the AS path to every network for the connectivity models from part (a). Express your answer in terms of A, D, and the number of networks N.

Questions 3
Suppose P, Q, and R are network service providers with respective CIDR address allocations C1.0.0.0/8, C2.0.0.0/8 and C3.0.0.0/8. Each provider’s customers initially receive address allocations that are a subset of the provider’s. P has the following customer:
   - PA, with allocation C1.A3.0.0/16
   - PB, with allocation C1.B0.0.0/12.

Q has the following customers:
   - QA, with allocation C2.0A.10.0/20
   - QB, with allocation C2.0B.0.0/16.
Assume that there are no other providers or customers.
   a) Give routing tables for P, Q, and R assuming that each provider connects to both of the others.
   b) Now assume that P is connected to Q and Q is connected to R, but P and R are not directly connected. Give routing tables for P and R.
   c) Suppose customer PA acquires a direct link to Q, and QA acquires a direct link to P, in addition to existing links. Give tables for P and Q, ignoring R.

Question 4
This question is related to Question 3 above. Assume each provider connects to both others. Suppose customer PA switches to provider Q and customer QB switches to provider R. Use the CIDR longest match rule to give routing tables for all three providers that allow PA and QB to switch without renumbering.