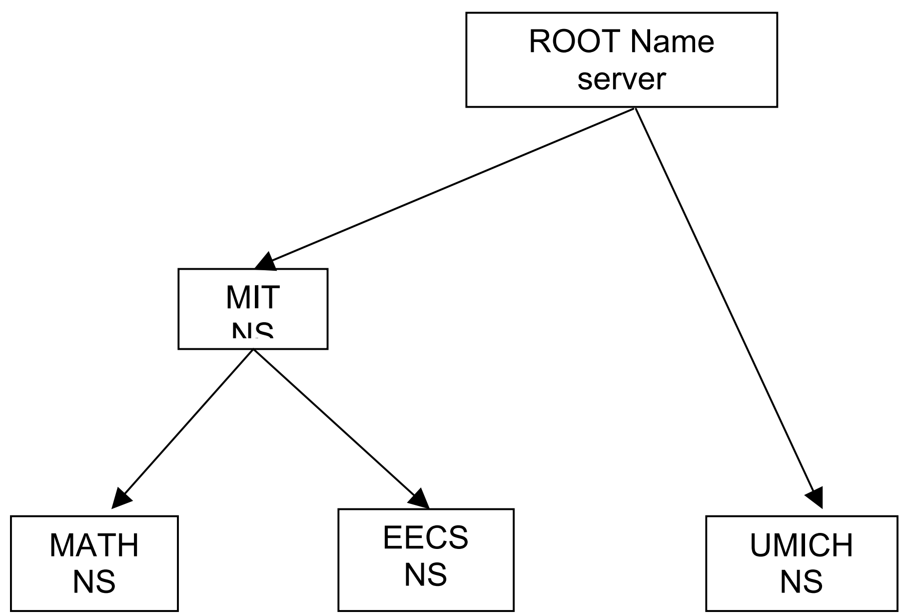
EECS 489 Homework I

Due: Mon, 2/15, in class

1. DNS Queries (13 points)

1. Show the DNS resolutions paths assuming the DNS hierarchies shown in the figure and assuming caching. Each query in the same order as below.(10 points)
    a. eecs.umich.edu looks up a.math.mit.edu
    b. eecs.umich.edu looks up b.eecs.mit.edu
    c. eecs.umich.edu looks up c.math.mit.edu
    d. d.math.mit.edu looks up c.math.mit.edu
    e. d.math.mit.edu looks up b.eecs.mit.edu

2. Also describe how DNS facilitates having the same domain name e.g. "umich.edu" for both the EMAIL as well as the Web servers. (3 points)



2. Packet Fragmentation (15 points)

Suppose Data-grams are limited to 1500 bytes (including header) between Host A and Router X. The MTU is 1000 bytes (including header) between Router X and Router Y and the MTU is 2000 bytes (including header) between Router Y and Destination B. Assume a IP-header of size 20 bytes. In total, how many datagram reach the destination B if the Host A is required to send an MP3 file of 4 million bytes? Explain neatly with the help of a figure the various fragments that are generated, their sizes and all the key fields of the datagram like: fragmentation offset, identifier and flag.

The network connection is as follows:
Host A → Router X → Router Y → Host B

3. Packet-switching vs. circuit-switching (4 points)

1. Give two advantages of packet-switching over circuit-switching? (2 point)
2. Give two advantages of circuit-switching over packet-switching? (2 point)

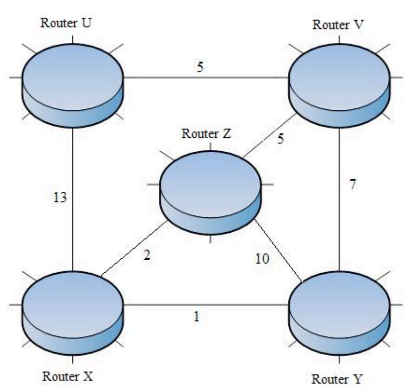
4. Socket Programming (10 points)

1. A call to `recv()` returns whatever amount of data has been received. Hence to retrieve the full amount of data sent, you may have to call recv() several times. List and describe the 3 ways you know you have received the full amount of data sent by the sender, and discuss the pros and cons of each. (6 points)
2. Why are `listen()` and `bind()` provided as separate functions? Why not merge them? (2 points)
3. Why are `listen()` and `accept()` provided as separate functions? Why not merge them? (2 points)

5. Classless Inter-domain Routing (CIDR) (15 points)
Consider a router that interconnects 3 subnets: Subnet 1, 2 and 3. Suppose all of the interfaces in each of these subnets are required to have the prefix 223.1.1.17/24. Also suppose that subnet 1 is required to support 125 interfaces and Subnets 2 and 3 are each required to suppose 40 interfaces. Provide 3 network addresses of the form a.b.c.d/x that satisfy these constraints.

6. Distance Vector Routing Protocol (20 points)

1. Consider the network shown below and assume that each node initially knows the cost of each of its neighbors. Consider the distance vector routing algorithm and show the distance table entries at router Z. (10 points)



2. Consider a general topology and a synchronous version of the Distance vector routing algorithm. Suppose that at each iteration, a node exchanges its distance vectors with its neighbors and receives their distance vectors. Assuming that the algorithm begins with each node only knowing the costs to its immediate neighbors, what is the maximum number of iterations before the algorithm converges? Answer in terms of C = the length of the longest path without loops between any two nodes of the network. Justify your answer. (There is a unique answer) (10 points)

7. NAT (15 points)

Consider the network structure shown below. Suppose that the network address of the home network is 192.168/16 and that the address of Router is 128.15.88.65.

1. Assign addresses to all interfaces in the home network. (5 points)

2. Suppose that each host has two ongoing TCP connections, all to port 80 at host 132.120.50.86. Provide the 6 corresponding entries in the NAT translation table. (10 points)