CPE 400/600: Computer Communication Networks

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**HW 4 (Total 20 points)**

1. **[3+2=5]** IP addressing:
2. A software company has 4000 computers. So it needs 4000 IP addresses. Assume class-full addressing. **What would be the ideal class from which the company would choose its IP addresses to prevent wastage of IP addresses?** **How many such networks would the company need for getting 4000 addresses?** **How many addresses would be wasted?**

**Answer 1:** The company should choose class C IP addresses to minimize waste.

**Answer 2:** The company would need 16 class C networks, each having 256 addresses. This would provide 4096 addresses total.

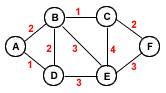
**Answer 3:** Since 4096 addresses are made available but only 4000 are needed, 96 would be wasted. One could also say that since each of the 16 networks has 2 reserved and unuseable addresses, only 96 – 16\*2 = 64 addresses were wasted.

1. If the company has the flexibility of classless addressing (CIDR addressing), **how many bits would be assigned to host part and how many bits assigned to network part?** **How many addresses would be wasted? (*SHOW YOUR STEPS, use the back of the page for calculations if necessary*)**

**Answer 1:** In a CIDR scheme we want the smallest number of host bits that can represent the number of addresses desired, ie we must find the smallest integer h that solves 2h ≥ 4000. In this case that number is 12 since 212 = 4096, so there will be 12 bits in the host part. Since the address is 32 bits total, the remainder will be the network part, 32 – 12 = 20 bits.

**Answer 2:** Since 4096 addresses are made available but only 4000 are needed, 96 would be wasted. Of these addresses, 2 would be reserved and unuseable, so one could also say only 94 addresses were wasted.

1. **[5]** Execute Dijkstra’s algorithm to find out the shortest path from source A to all other nodes. Show your trace table clearly with each of the shortest paths and distances as discussed in class.



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Step | N’ | D(b),P(b) | D(c),P(c) | D(d),P(d) | D(e),P(e) | D(f),P(f) |
| 0 | a | 2, a | ∞ | 1, a | ∞ | ∞ |
| 1 | ad | 2, a | ∞ |  | 4, d | ∞ |
| 2 | abd |  | 3, b |  | 4, d | ∞ |
| 3 | abcd |  |  |  | 4, d | 5, f |
| 4 | abcdf |  |  |  |  | 5, f |
| 5 | abcdef |  |  |  |  |  |

1. **[2+2+2=6]** What are the major differences between:
   1. **RIP and OSPF routing protocol**

RIP and OSPF are both intra-domain or intra-AS routing protocols. The main way in which they differ is in the routing algorithm which has been implemented for routing: RIP is implemented using a Bellman-Ford/distance vector approach, and OSPF is implemented using a Dijkstra’s algorithm/link state approach. OSPF is also open source, where RIP originated with a proprietary Cisco design.

* 1. **Intra and inter AS routing protocol**

Intra-AS routing protocols like RIP and OSPF govern the routing of data within a single autonomous system (AS). Once a packet arrives at an AS, these protocols handle its eventual delivery to the desired location within the AS. These protocols also handle traffic within the AS that does not go out to the wider internet.

Inter-AS routing protocols, namely BGP, handle routing between different AS. BGP provides a framework for subnets to advertise their existence and get reachability information from neighboring AS, thus allowing for data routing between the different AS that make up the internet.

* 1. **RIP and DSR protocol**

RIP is a proactive routing protocol built on the Bellman-Ford/distance vector approach, which assumes that a network is relatively stable, there are few router failures, and routes to all destinations can be discovered and maintained. DSR is a reactive routing protocol that can be used when RIP’s assumptions do not apply, for example in a dynamic mobile environment where drastic change frequently occurs. DSR uses RREQ, RREP, and RERR messages to acquire, spread, and update information about the network in an ad-hoc fashion, whereas RIP maintains distance vectors from each node to all other nodes.

1. **[4]** Given the following Host IP Address, Network Mask and Subnet mask,

IP address: 192.168.0.10. Network mask: 255.255.255.0. Subnet mask: 255.255.255.224.

Find the following information (*use the back of the paper to show your calculations if necessary*):

First, note 224 is 11100000 in binary. Thus in the last 8 bits of the address, the leftmost 3 are used for subnet and the rightmost 5 are used for hosts. Thus for host 10 in decimal, which is 00001010 in binary, we are in subnet 0.

1. **Major Network Address:**

192.168.0.0

1. **Major Network Broadcast Address**

192.168.0.255

1. **Range of Hosts if not subnetted:**

192.168.0.1 – 192.168.0.254 (253 hosts)

1. **Subnet Address:**

192.168.0.0

1. **Range of Host Addresses (first host and last host) in the subnet:**

192.168.0.1 – 192.168.0.30 (since the 3 leftmost bits are locked to 0, and the remaining 5 bits include all possibilities except all 0s and all 1s)

1. **Broadcast Address in the subnet:**

192.168.0.31 (3 leftmost bits locked to 0, 5 remaining bits all 1)

1. **Total number of subnets:**

23 = 8

1. **Number of hosts per subnet:**

25 – 2 = 30