There are two parts to this assignment. Please make sure to complete all parts.

**Part 1: Backbone Networks**

Review the diagram of the backbone network below, and then answer the series of questions.



1. The textbook explains the three layers that exist in a backbone network. The diagram above has several labeled computers, switches, and routers that are part of these layers. For all labeled devices, identify their layer, and explain the function the device plays in this backbone network.

2. The textbook describes three types of backbone networks – switched, routed, and a mixture of the two. What type of backbone network does this diagram illustrate? Explain your answer.

3. Imagine that Computer 1 broadcasts a data-link layer frame.

1. Would other computers or devices on LAN 1 receive this broadcast? Explain your answer.
2. Would this broadcast be restricted only to a single LAN, or to multiple LANs? Explain your reasoning.

4. Imagine that Computer 1 generates an IPv4 packet that is destined for Computer 3. Assume that Computer 1 knows the IPv4 address of Computer 3, and also assume that the forwarding and routing tables of all switches and routers respectively are fully populated to ensure readily available end-to-end communication between any two devices. Explain step-by-step how that IPv4 packet will travel the network to arrive at its destination. In your answer, make sure to identify the source and destination MAC and IPv4 addresses by labeling them with the attached device name, for example, “Computer 3’s MAC address” or “Computer 3’s IP address”.

5. Imagine that all of the routers except for Router B and Router C are replaced with switches.

1. What would the new backbone architecture be (switched, routed, or hybrid)? Explain.
2. If Computer 1 broadcasts a data-link layer frame with this new architecture, which LANs and devices would receive this broadcast?
3. Suppose that a total of few hundred employees work in Building 1 and Building 2 with many more LANs than what is illustrated in the diagram. What would be the advantages and disadvantages of this new architecture as compared to the old?

**Part 2: Wide Area Networks (WANs)**

Review the architectural diagram of the WAN below, which illustrates a single organization’s WAN links between its campuses across the United States.



6. The textbook describes four types of WAN configurations – ring, star, partial mesh, and full mesh. Which configuration is illustrated in the diagram above? Explain your answer.

7. Imagine that network traffic is coming from Portland and traveling to Miami. The most obvious route the traffic can take is Portland to Miami, due to the direct connection between the two campuses. Assuming all WAN links are operational, identify a two-hop route, a three-hop route, a four-hop route, and a five-hope route between Portland and Miami.

8. Now imagine that both Kansas City and San Antonio are entirely offline. How many operational routes would there be from Portland to Miami? Identify each route along with its number of hops.

9. Imagine that the organization needs to remove four WAN links to save on cost (and that all links are operational again). Identify four links to be removed. You should ensure that, between any two campuses, the new configuration has *at least one route* that contains no more than two hops. It is fine if other routes are more than two routes, but there should be at least one route that is no more than two hops between any two campuses.

10. With the four WAN links removed, what is the new WAN configuration, ring, star, partial mesh, or full mesh? What are the advantages of the new configuration over the old? Explain your answer.

Your assignment will be evaluated according to the following rubric.

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|  | **Grade** | **Qualities Demonstrated by the Assignment Submission** | **Grade Assigned** |
| **Content (70%)**  **Measures the quality of the content in the assignment** | A+ 🡺 100 | The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. There is no known way to improve the content, and there are absolutely no technical or coverage errors present. |  |
| A 🡺 96 | The content demonstrates exceptional understanding of all relevant subject matter and its inter-relationships. All major relevant issues are thoroughly covered, and all content is very focused and on-topic. At most one insignificant technical or coverage error may be present |
| A- 🡺 92 | The content demonstrates deep understanding of all relevant subject matter and its inter-relationships. All major relevant issues are covered, and all content is on-topic. |
| B+ 🡺 88 | The content demonstrates understanding of all relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and the content is at least reasonably on-topic. |
| B 🡺 85 | The content demonstrates understanding of most relevant subject matter and its inter-relationships. Almost all major relevant issues are covered, and all content is at least reasonably on-topic. |
| B- 🡺 82 | The content demonstrates moderate understanding of much relevant subject matter and its inter-relationships. There is reasonable coverage of major relevant issues, and the content is at least reasonably on-topic. |
| C+ 🡺 78 | The content demonstrates some understanding of relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least some content is on-topic. |
| C 🡺 75 | The content demonstrates understanding of a small portion of the relevant subject matter and its inter-relationships. Some major relevant issues are covered, and at least a small portion of the content is on-topic. |
| C- 🡺 72 | The content demonstrates little understanding of and insight into the relevant subject matter and its inter-relationships. A small portion of the major relevant issues are covered. The focus of the content may be off topic or on insubstantial or secondary topics |
| D 🡺 67 | The content demonstrates almost no understanding of or insight into the relevant subject matter and its inter-relationships. Almost none of the major relevant issues are covered, and the content may be almost entirely off-topic. |
| F 🡺 0 | The content demonstrates no understanding of or insight into the relevant subject matter and its inter-relationships. No major relevant issues are covered, and the content is entirely off-topic. |
| **Exposition (30%)**  **Measures how well the content is expressed** | A+ 🡺 100 | The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There is no known way to improve the clarity or organization of the submission. |  |
| A 🡺 96 | The presentation of all ideas and designs is exceptionally clear and persuasive; the entire submission is exceptionally organized. There may be at most one insignificant way to improve the clarity or organization of the submission. |
| A- 🡺 92 | The presentation of all ideas and designs is very clear and persuasive; the entire submission is very organized. |
| B+ 🡺 88 | The presentation of all ideas and designs is clear and persuasive; the entire submission is organized. |
| B 🡺 85 | The presentation of most ideas and designs is clear and persuasive; most of the submission is organized. |
| B- 🡺 82 | The presentation of most ideas and designs is generally clear; most of the submission is reasonably organized. |
| C+ 🡺 78 | Some parts of the submission are hard to understand; some parts are disorganized. |
| C 🡺 75 | About half of the submission is hard to understand; about half is disorganized. |
| C- 🡺 72 | Most parts of the submission are hard to understand; most parts are disorganized. |
| D 🡺 67 | Almost all of the submission is hard to understand and disorganized. |
| F 🡺 0 | The entire submission is hard to understand and disorganized. |
| **Overall Assignment Grade:** | | | |

Use the **Ask your Facilitator Discussion Board** if you have any questions regarding how to approach this assignment.

Save your assignment as ***lastnameFirstname\_assignment4.doc*** and submit it in the *Assignments* section of the course.

For help uploading files please refer to the *Technical Support* page in the syllabus.