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| **Task 1: Design an IP Addressing Scheme using VLSM** **(Total marks = 12)**  For the IP addressing scheme, assign unique subnets to each department in each branch. Utilise a subnetting method that optimises IP address allocation while allowing for future scalability. Ensure IP addresses are efficiently assigned to devices.  Given an IP address and mask of 192.168.10.0/24, design an IP addressing scheme that satisfies the following requirements in the table below using VLSM for efficient use of IP addresses.  The 0th subnet is used. No subnet calculators should be used.   |  |  | | --- | --- | | **Location:** Subnet | **Number of Hosts** | | **London Head Office:** IT Office (Subnet A) | 6 | | **Wroclaw Branch:** Sales Office (Subnet B) | 6 | | **York Branch:** Marketing (Subnet C) | 6 |      |  |  |  | | --- | --- | --- | | **IT (Subnet A)** |  |  | | **Specification** | **Student Input** | **Marks (4 marks)** | | Default Subnet Mask (Binary) | 11111111.11111111.11111111.00000000 |  | | Custom subnet mask (Decimal) | 255.255.255.240 |  | | Total number of subnets | 16 |  | | Total Number of host addresses | 16 |  | | Number of usable addresses | 14 |  | | Number of bits borrowed | 4 |  | | First IP Host address | 192.168.2.1 |  | | Last IP Host address | 192.168.2.14 |  |      |  |  |  | | --- | --- | --- | | **Sales Office (Subnet B)** |  |  | | **Specification** | **Student Input** | **Marks (4 marks)** | | Default Subnet Mask (Binary) | 11111111.11111111.11111111.00000000 |  | | Custom subnet mask (Decimal) | 255.255.255.240 |  | | Total number of subnets | 16 |  | | Total Number of host addresses | 16 |  | | Number of usable addresses | 14 |  | | Number of bits borrowed | 4 |  | | First IP Host address | 192.168.2.17 |  | | Last IP Host address | 192.168.2.30 |  |      |  |  |  | | --- | --- | --- | | **Marketing (Subnet C)** |  |  | | **Specification** | **Student Input** | **Marks (4 marks)** | | Default Subnet Mask (Binary) | 11111111.11111111.11111111.00000000 |  | | Custom subnet mask (Decimal) | 255.255.255.240 |  | | Total number of subnets | 16 |  | | Total Number of host addresses | 16 |  | | Number of usable addresses | 14 |  | | Number of bits borrowed | 4 |  | | First IP Host address | 192.168.2.33 |  | | Last IP Host address | 192.168.2.46 |  |     **Task 2: Build and Configure the Network (Total marks = 18)**  Build the network infrastructure as depicted in the provided diagram using Cisco Packet Tracer. Connect the Headquarters in London with the Wroclaw and York branches using appropriate network devices such as routers, switches. Configure the devices with the designated IP addresses from the addressing scheme mentioned in Task 1.    Step 1: Select all the devices such as PCs, Switches, and Routers.  Step 2: Cable the network as shown in the topology.  Step 3: Configure the IP addresses and default gateway for the end devices (PC). The network router will use the FIRST network host address. Host computers will use any address in the subnet.    After configuring each host computer, record the host network settings with the ipconfig /all command and write down the information using the table below.  **London Site**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **IT Office** | | | | | | | **Device** | **IP address** | **Subnet Mask** | **Gateway** | **MAC Address** | **Marks (6 marks)** | | PC IT-1 | 192.168.2.2 | 255.255.255.240 | 192.168.2.1 | 0001.C9CD.EDC0 |  | | PC IT-2 | 192.168.2.3 | 255.255.255.240 | 192.168.2.1 | 0002.16CB.4888 |  | | PC IT-3 | 192.168.2.4 | 255.255.255.240 | 192.168.2.1 | 0060.3E10.DD52 |  | | PC IT-4 | 192.168.2.5 | 255.255.255.240 | 192.168.2.1 | 00D0.BA1C.4A25 |  | | PC IT-5 | 192.168.2.6 | 255.255.255.240 | 192.168.2.1 | 00E0.B08D.C36D |  | | PC IT-6 | 192.168.2.7 | 255.255.255.240 | 192.168.2.1 | 00D0.FF3B.0DAA |  |   **Wroclaw Site**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Sale Office** | | | | | | | **Device** | **IP address** | **Subnet Mask** | **Gateway** | **MAC Address** | **Marks (6 marks)** | | PC Sale-1 | 192.168.2.18 | 255.255.255.240 | 192.168.2.17 | 00D0.D3BD.3C22 |  | | PC Sale-2 | 192.168.2.19 | 255.255.255.240 | 192.168.2.17 | 000A.4171.79A7 |  | | PC Sale-3 | 192.168.2.20 | 255.255.255.240 | 192.168.2.17 | 0030.F206.CAB5 |  | | PC Sale-4 | 192.168.2.21 | 255.255.255.240 | 192.168.2.17 | 00D0.BAB6.D9B4 |  | | PC Sale-5 | 192.168.2.22 | 255.255.255.240 | 192.168.2.17 | 0005.5E32.87AA |  | | PC Sale-6 | 192.168.2.23 | 255.255.255.240 | 192.168.2.17 | 0001.96C7.5B89 |  |   **York Site**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Marketing Office** | | | | | | | **Device** | **IP address** | **Subnet Mask** | **Gateway** | **MAC Address** | **Marks (6 marks)** | | PC Market-1 | 192.168.2.34 | 255.255.255.240 | 192.168.2.33 | 0002.1731.4759 |  | | PC Market-2 | 192.168.2.35 | 255.255.255.240 | 192.168.2.33 | 00D0.BC1B.912E |  | | PC Market-3 | 192.168.2.36 | 255.255.255.240 | 192.168.2.33 | 0090.2B7D.ADA1 |  | | PC Market-4 | 192.168.2.37 | 255.255.255.240 | 192.168.2.33 | 000A.F387.3645 |  | | PC Market-5 | 192.168.2.38 | 255.255.255.240 | 192.168.2.33 | 0001.43CC.E50D |  | | PC Market-6 | 192.168.2.39 | 255.255.255.240 | 192.168.2.33 | 0001.4293.1CA9 |  |   **Task 3: Use Routing Protocol for Communication (Total marks = 15)**  Implement a suitable dynamic routing protocol to facilitate communication between routers in the network. Ensure efficient routing of data packets between different subnets and branches.  Step 1: Enter the IP addresses and configure the following router interfaces using the table provided below:   |  |  |  | | --- | --- | --- | | **Device** | **IP address** | **Marks (4 Marks)** | | Router 3- se0/1/0 | 5.0.0.1 |  | | Router 3- se0/1/1 | 4.0.0.1 |  | | Router 4-Se0/1/0 | 4.0.0.2 |  | | Router 4-Se0/1/1 | 7.0.0.1 |  | | Router 5-Se0/1/0 | 7.0.0.2 |  | | Router 5-Se0/1/1 | 6.0.0.2 |  | | Router 6-Se0/1/0 | 5.0.0.2 |  | | Router 6-Se0/1/1 | 6.0.0.1 |  |     Step 2: Enter the IP addresses, subnet masks and configure the following router interfaces using addressing scheme mentioned in Task 1.  **Record IP Address for interface indicated in the table below**.   |  |  |  |  | | --- | --- | --- | --- | | **Device** | **IP address** | **Subnet Mask** | **Marks (4 marks)** | | Router 3-Gig 0/0 | 1.0.0.2 | 255.0.0.0 |  | | Router 5-Gig 0/0 | 3.0.0.2 | 255.0.0.0 |  | | Router 6-Gig 0/0 | 2.0.0.2 | 255.0.0.0 |  | | Router 0-Gig 0/1 | 1.0.0.1 | 255.0.0.0 |  | | Router 1-Gig 0/1 | 2.0.0.1 | 255.0.0.0 |  | | Router 2-Gig 0/1 | 3.0.0.1 | 255.0.0.0 |  |   Step 3: Configuration tasks for each Routers should also include the following:     |  |  |  | | --- | --- | --- | | **Task** | **Specification** | **Marks (4 marks)** | | Router name | Router (number) |  | | Encrypted privileged exec password | cisco |  | | Console access password | class (number) |  | | Telnet access password | class (number) |  |     Step 4: show the Routing Table for each Router.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Device** | **Protocol** | **Networks Advertised** | **Configuration Commands** | **Marks (3 marks)** | | Router 3 | OSPF | 192.168.2.0/28, 192.168.2.16/28, 192.168.2.32/28 | |  | | --- | | router ospf 1 network 1.0.0.0 0.255.255.255 area 0 network 4.0.0.0 0.255.255.255 area 0 network 5.0.0.0 0.255.255.255area 0 | | | Router 4 | OSPF | 192.168.2.0/28, 192.168.2.16/28, 192.168.2.32/28 | router ospf 1 network 1.0.0.0 0.255.255.255 area 0 network 4.0.0.0 0.255.255.255 area 0 network 5.0.0.0 0.255.255.255area 0 | | Router 5 | OSPF | 192.168.2.0/28, 192.168.2.16/28, 192.168.2.32/28 | router ospf 1 network 1.0.0.0 0.255.255.255 area 0 network 4.0.0.0 0.255.255.255 area 0 network 5.0.0.0 0.255.255.255area 0 | | Router 6 | OSPF | 192.168.2.0/28, 192.168.2.16/28, 192.168.2.32/28 | router ospf 1 network 1.0.0.0 0.255.255.255 area 0 network 4.0.0.0 0.255.255.255 area 0 network 5.0.0.0 0.255.255.255area 0 |   **Task 4: Use Ping and Traceroute Commands for Basic Network Testing (Total marks = 15)**  Conduct network testing using the ping and traceroute commands to ensure connectivity between devices. Troubleshoot and rectify any connectivity issues that may arise during testing.  Ping and traceroute are two tools which are indispensable when testing TCP/IP network connectivity. Ping is a network administration utility used to test the reachability of a device on an IP network.  The traceroute utility is a network diagnostic tool for displaying the route and measuring the transit delays of packets travelling an IP network.    Step 1: Use the ping command to verify network connectivity.  Network connectivity can be verified with the **ping** command.  Use the following table to methodically verify connectivity with each network device. Take corrective action to establish connectivity if a test fails:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **From** | **To (Destination)** | **IP Address (Destination)** | **Ping results**  **(Screenshots)** | **Marks (7 marks)** | | PC IT-1 | PC IT-2 | 192.168.2.3 |  |  | | PC Sale-2 | PC Market-4 | 192.168.2.37 |  |  | | PC Market-1 | PC IT-5 | 192.168.2.6 |  |  | | PC Sale-2 | Router3 se0/1/1 | 4.0.0.1 |  |  | | PC Sale-6 | PC IT-4 | 192.168.2.5 |  |  | | PC IT-1 | Router 1-Gig 0/1 | 2.0.0.1 |  |  |                 Step 2: Use the **Tracert** command to verify network connectivity.  Use the **Tracert** command to trace the path to a specific destination and write down the path to the destination.     |  |  |  |  |  | | --- | --- | --- | --- | --- | | **From** | **To (Destination)** | **IP Address (Destination)** | **Path to destination**  **(Screenshots)** | **Marks (8 marks)** | | PC Sale-3 | PC Sale-1 | 192.168.2.18 |  |  | | PC Market-5 | Router4 se/0/1/1 | 6.0.0.1 |  |  | | PC IT-1 | Router3 se0/1/0 | 5.0.0.1 |  |  | | PC Sale-5 | PC Market-2 | 192.168.2.35 |  |  | | PC IT-1 | PC Market-3 | 192.168.2.36 |  |  | | PC Market-1 | Router 2-Gig 0/1 | 3.0.0.1 |  |  | |