Logo

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Faculty of Science and Engineering

School of Computing and Information Science

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**Module Title: Computer Systems**

**Element 010-3**

**Lab Logbook**

**SID NUMBER: \_\_\_\_\_\_\_**

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# Logbook activity 1: Number Systems

## 1. Binary to decimal (base 2 to base 10)

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| Convert the following binary numbers into decimal. Show your working. [12 marks]   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1. 110011012  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | |  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |  | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | |  | 128 | 64 | 0 | 0 | 8 | 4 | 0 | 1 | | TOTAL | 128+64+8+4+1=20510 | | | | | | | | |  | 1. 11011012  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | 1 | 1 | 0 | 1 | 1 | 0 | 1 | |  | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |  | 64 | 32 | 16 | 8 | 4 | 2 | 1 | |  | 64 | 32 | 0 | 8 | 4 | 0 | 1 | | TOTAL | 64+32+8+4+1=10910 | | | | | | | |  |   110011012 = 20510 11011012 = 10910 |

## 2. Decimal to binary (base 10 to base 2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Convert the following decimal numbers into binary. Show your working. [12 marks]   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1. 11810  |  |  |  | | --- | --- | --- | |  | **Quotient** | **Remainder** | | 2 | 59 | 0 | |  |  |  | | 2 | 29 | 1 | |  |  |  | | 2 | 14 | 1 | |  |  |  | | 2 | 7 | 0 | |  |  |  | | 2 | 3 | 1 | |  |  |  | | 2 | 1 | 1 | |  |  |  | | 2 | 0 | 1 | |  |  |  | | 2 |  |  | |  | 11810 =11101102 |  | |  | 1. 14910  |  |  |  | | --- | --- | --- | |  | **Quotient** | **Remainder** | | 2 | 74 | 1 | |  |  |  | | 2 | 37 | 0 | |  |  |  | | 2 | 18 | 1 | |  |  |  | | 2 | 9 | 0 | |  |  |  | | 2 | 4 | 1 | |  |  |  | | 2 | 2 | 0 | |  |  |  | | 2 | 1 | 0 | |  |  |  | | 2 | 0 | 1 | |  |  |  | | 2 |  |  | |  | 14910 = | 100101012 | |  | |

## 3. Hexadecimal to decimal (base 16 to base 10)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Convert the following hexadecimal numbers to decimal. Show your working. [12 marks]   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1. 935E16  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | 9 | 3 | 5 | E | |  | 3 | 2 | 1 | 0 | |  | 44096 | 256 | 16 | 1 | |  | 36864 | 768 | 80 | 14 | | TOTAL | 36864+768+80+14=3772610 | | | |   935E16 = 3772610 |  | 1. BD1E16  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | B | D | 1 | E | |  | 3 | 2 | 1 | 0 | |  | 4096 | 256 | 16 | 1 | |  | 45056 | 3328 | 16 | 14 | | TOTAL | 45056+3328+16+14=4841410 | | | |   BD1E16 = 4841410 |  | |

## 4. Decimal to hexadecimal (base 10 to base 16)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Convert the following decimal numbers to hexadecimal. Show your working. [12 marks]   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1. 4921010  |  |  |  |  | | --- | --- | --- | --- | |  | **Quotient** | **Remainder** | **Hexadecimal** | | 16 | 3075 | 10 | A | |  |  |  |  | | 16 | 192 | 3 | 3 | |  |  |  |  | | 16 | 12 | 0 | 0 | |  |  |  |  | | 16 | 0 | 12 | C | |  |  |  |  | |  | 4921010 | =C03A16 |  | |  |  |  |  | |  | 1. 3621410  |  |  |  |  | | --- | --- | --- | --- | |  | **Quotient** | **Remainder** | **Hexadecimal** | | 16 | 2263 | 6 | 6 | |  |  |  |  | | 16 | 141 | 7 | 7 | |  |  |  |  | | 16 | 8 | 13 | D | |  |  |  |  | | 16 | 0 | 8 | 8 | |  |  |  |  | |  | 3621410 | =8D7616 |  | |  |  |  |  | |  | |

## 5. Value-added work

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| For each question part (48 in total), an additional 1 mark is available if working is shown (even if the answer is incorrect). There are therefore an additional [48 marks] available for showing working. |

6. Self-reflection and feedback

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| After completing the lab, please answer the following questions in your logbook. [An automatic 4 marks is awarded for full completion of this section.]   1. **Roughly how long did it take you to complete this lab and write up the logbook?**   I took around 40 mins to solve this.     1. **On a scale of 1 (very easy) to 5 (very hard), how difficult did you find this lab?**   I will give 2 because it was easy for me.   1. **Which parts did you find the least challenging?**   The least challenging part was part2.   1. **Which parts did you find the most challenging?**   The most challenging part was part4.   1. **On a scale of 1 (not very confident at all) to 5 (very confident), how confident are you now with converting between different number systems?**   I am very confident about this, so I’ll give 5.   1. **Please list any external resources (textbooks, websites, other people, etc.) used when completing this lab or the logbook.**   I haven’t used anything except calculator because I was familiar with this before. |

# Logbook activity 2: Logic Gates

## 1. Creating truth tables from existing logic diagrams

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Complete the truth tables for the following logic diagrams. [40 marks]   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | D=A.B  AND GATE NOT    OR  F=+E  NAND  E= | NOR X=)   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | A | B | C | D=A.B |  | E= | F=+E | **X**=) | | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | | |

## 2. Creating logic diagrams and truth tables from real-life scenarios

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A nuclear power station has a safety system based on three inputs to a logic network. A warning signal (S = 1) is produced when certain conditions in the nuclear power station occur based on these three inputs:  Macintosh HD:Users:ivan:Desktop:Screen Shot 2016-01-20 at 21.54.04.png  A warning signal (S = 1) will be produced when either a) OR b) are TRUE:   1. Temperature > 115°C AND Cooling water <= 120 litres/hour   In this case , warning signal (S=1) will be produced if temperature > 115°C AND Cooling water <= 120 litres/hour   1. Temperature <= 115°C AND (Reactor pressure > 15 bar OR   Cooling water <= 120 litres/hour)  In this case , warning signal (S=1) will be produced if Temperature <= 115°C AND (Reactor pressure > 15 bar OR Cooling water <= 120 litres/hour)  Draw a logic diagram and truth table to show all the possible situations when the warning signal (S) could be received. [45 marks]  **Go to** [**https://online.visual-paradigm.com/diagrams/features/logic-diagram-software/**](https://online.visual-paradigm.com/diagrams/features/logic-diagram-software/)**, to draw logic diagrams online.**  Therefore , when T=1 , R = 0 and C=1  So S will be 0  Therefore , we can write expression as :  S=T.C’ + T’.(R+C’)  **Answer: So the Truth Table will be:(T,R,C: inputs and S:output)**   |  |  |  |  | | --- | --- | --- | --- | | **T** | **R** | **C** | **S** | | **0** | **0** | **0** | **1** | | **0** | **0** | **1** | **0** | | **0** | **1** | **0** | **1** | | **0** | **1** | **1** | **1** | | **1** | **0** | **0** | **1** | | **1** | **0** | **1** | **0** | | **1** | **1** | **0** | **1** | | **1** | **1** | **1** | **0** |   **Logic Diagram:** |

## 3. Value-added work

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| --- |
| Additional marks are available if your answers satisfy the following criteria:   * **Question 1.** Are attempted. All intermediate logic gates are labelled, and their outputs added to the truth table. [5 marks] * **Question 2.** Are attempted. All inputs and outputs in logic diagrams are fully labelled and explained. [5 marks]   Your answers do not necessarily need to be correct to satisfy the above criteria. No “part marks” will be awarded (you will be awarded either 0 or 5 marks per criterion). |

## **4. Self-reflection and feedback**

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| --- |
| After completing the lab, please answer the following questions in your logbook. [5 marks]   * + - 1. Roughly how long did it take you to complete this lab and write up the logbook?   2 hours   * + - 1. On a scale of 1 (very easy) to 5 (very hard), how difficult did you find this lab?   5 (very hard)   * + - 1. Which parts did you find the least challenging?   Part 1 was least challenging.   * + - 1. Which parts did you find the most challenging?   Part 2 was least challenging.   * + - 1. On a scale of 1 (not very confident at all) to 5 (very confident), how confident are you now with logic gates, truth tables and logic diagrams?   4 (Confident)   * + - 1. Please list any external resources (textbooks, websites, other people, etc.) used when completing this lab or the logbook.   I took help from my friend in order to make logic and then I made the diagram on the website. |

# Logbook activity 3: Introduction to Packet Tracer

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Instruction:** Provide screenshots and explanation throughout to provide evidence of your work.  **Task 1.** Start a New Packet Tracer activity and connect two PCs and a switch as shown:  Graphical user interface, application, Excel  Description automatically generated  **Task 1.1.** Configure the two PCs Ethernet interfaces with the IP addresses shown and prove that they can communicate by sending ping between them.   * + **PC0** IP Address: **192**.**168.1.10**   + **PC0** Subnet Mask: **255.255.255.0**   + **PC1** IP Address: **192.168.1.11**   + **PC1** Subnet Mask: **255.255.255.0**   + Ping worked  |  | | --- | | 00D0.FF90.6345 | | 0003.E42A.B9D4 |  * + MAC Address of **PC0**   + MAC Address of **PC1**     Proof:(Screenshot)  **Task 2.** Extend the topology as shown below.  Diagram  Description automatically generated with medium confidence  **Task 2.1**. Configure the Ethernet interface on **Server0** with     * + IP Address: **192.168.2.254**   + Subnet mask: **255.255.255.0**   **Task 2.2.** On **Server0** configure the DHCP service with   * + Default Gateway: **192.168.2.1**   + DNS Server: **192.168.2.254**   + Start IP Address: **192.168.2.10**   + Subnet Mask: **255.255.255.0**   + Maximum number of users: **89**   + Turn the Service On   + Save the configuration.   **Task 2.3.** Configure **PC2** and **PC3** to use a DHCP IP configuration.   * + What is **PC2**  |  | | --- | | 192.168.2.1 | | 192.168.2.254 | | 192.168.2.10 | | 255.255.255.0 |  * + 1. Default Gateway     2. DNS Server     3. IP Address     4. Subnet Mask   + What is **PC3**  |  | | --- | | 192.168.2.1 | | 192.168.2.254 | | 192.168.2.11 | | 255.255.255.0 |  * + 1. Default Gateway     2. DNS Server     3. IP Address     4. Subnet Mask   **Task 2.4.** Check that **PC2** can ping **PC3**  Proof: (screenshot)  Diagram  Description automatically generated with medium confidence**Task 3.** Extend the topology as shown below. Note that the switches are connected to the routers using the Gigabit interfaces and that the lights on the interfaces remain at red.  **Task 3.1.** Configure the Gigabit interface on **Router0** and notice that there is an IOS command window that indicates the commands being executed to perform the configuration. You will learn more about this during the module.   * + IP Address: **192.168.1.1**   + Subnet Mask: **255.255.255.0**   + It is also necessary to change Port Status to: **On**   + The interface lights have now turned green:   **Task 3.2.** Repeat (4.1) with **Router1** with   * + IP Address: **192.168.2.1**   + Subnet Mask: **255.255.255.0**   + It is also necessary to change Port Status to: **On**   + The interface lights have now turned green:   **Task 3.3.** **PC2** should be able to ping the router interface **192.168.2.1**   * If the ipconfig is executed at the command prompt, it should show the Default Gateway as **192.168.2.1** * This is because we set the DHCP server to inform the PC that this was the Default Gateway value (check 3.2 & 3.3) * Research online and write on your words what is a Default Gateway?  |  | | --- | | Default gateway is a device that forwards data from one network to another and most of a time, this is going to be a router. In local area network, we usually have router, switch and the computers and on the other side of the router we have the internet which is another network so in order for these computers to access another network such as a web page out on the internet the data has to exit its own local network by going through the default gateway which is the router and then the router will forward the data to the internet. Now this also works both ways. So, if a device on the internet wanted to communicate with the computer on this network, it must go through this network's default gateway and then to the computer. |   **Task 3.4.** Check that **PC1** can ping **192.168.1.1**   * And that **ipconfig** shows the Default Gateway as **0.0.0.0** * This is because we did not manually set the Default Gateway. * Configure the Default Gateway of **PC1** to **192.168.1.1**. Do not configure the Default Gateway of **PC0** at this point.   **Task 4.** Complete the topology by connecting the two routers together using a cross-over cable (a dotted one).   * + Configure and enable the second Router0 Gigabit interface as     - IP Address: **192.168.3.1**     - Subnet Mask: **255.255.255.252**   + Configure and enable the second Router1 Gigabit interface as     - IP Address: **192.168.3.2**     - Subnet Mask: **255.255.255.252**   + The lights on the interface between the two routers is now Green   **Task 4.1.** Select the CLI tab for **Router1**.   * + Keep entering exit until the prompt changes to **Router#**   + Ping the other router   **Task 4.2.** Testing   * + **PC0** and **PC1** can communicate   + **PC2** and **PC3** can communicate   + **PC1** can communicate with **Router0**   + **PC3** can communicate with **Router1**   + **Router1** can communicate with **Router0**   + **PC1** can communicate **PC3**   **Task 4.3.** -10 marks if you ticked the final box. You should get request timed out.  **Task 4.4.** At the **PC1** Command Prompt issue the command **netstat –r**. Copy the information about the active routed in the box below.   |  | | --- | | Proof: (screenshot) |   This is the Routing Table in the PC and should tell you that for any network destination it does not know (**0.0.0.0**) then it will ship the packet to **192.168.1.1** (the Default Gateway) via the **192.168.1.11** (FastEthernet) interface.  **Task 4.5.** On **Router0**, if it shows ‘Press **RETURN** to get started’ then press **Return**, otherwise enter the command exit until you reach the **Router> prompt**.   * + Enter the command **show ip route**.   + Enter the lines displayed after ‘Gateway of last resort not set’ in the box below  |  | | --- | | 192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.1.0/24 is directly connected, GigabitEthernet0/0  L 192.168.1.1/32 is directly connected, GigabitEthernet0/0  192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.3.0/30 is directly connected, GigabitEthernet0/1  L 192.168.3.1/32 is directly connected, GigabitEthernet0/1 |   Now note the lines starting with ‘L’. This means the router only knows about its own Local interfaces. In order for it to pass packets to the other router it must know about it. We are going to set this up manually.  **Task 4.6.** In the Config tab for **Router0** Click on the Static button under Routing. Enter the following information   * + Network **192.168.2.0**   + Mask **255.255.255.0**   + Next Hop **192.168.3.2** (what route to take to get to the destination network)   + Click on **Add**   + Enter the **show ip route** command in **Router0** CLI tab. What is the difference in the Routing Table compared to the previous time?   **Ans:** There is an additional line now which is; “(S 192.168.2.0/24 [1/0] via 192.168.3.2)”  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.1.0/24 is directly connected, GigabitEthernet0/0  L 192.168.1.1/32 is directly connected, GigabitEthernet0/0  S 192.168.2.0/24 [1/0] via 192.168.3.2)”  192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.3.0/30 is directly connected, GigabitEthernet0/1  L 192.168.3.1/32 is directly connected, GigabitEthernet0/1  **Task 4.7.** Testing   * + **PC0** and **PC1** can communicate   + **PC2** and **PC3** can communicate   + **PC1** can communicate with **Router0**   + **PC3** can communicate with **Router1**   + **Router1** can communicate with **Router0**   + **PC1** can communicate **PC3**   **Task 4.8.** -20 marks if you ticked the final box (you should have learnt from last time). You should get request timed out.  **Task 4.9.** Although **Router0** knows how to get to **192.168.2.0** network **Router1** does not know how to send the response back to **PC1**. Configure **Router1** with the info below.   * + Network: **192.168.1.0**   + Mask: **255.255.255.0**   + Next Hop: **192.168.3.1** (what route to take to get to the destination network)   + Click on Add   + Enter the **show ip route** command in **Router1** CLI tab. What is the difference in the Routing Table compared to the previous time?  |  | | --- | | S 192.168.1.0/24 [1/0] via 192.168.3.1  192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.2.0/24 is directly connected, GigabitEthernet0/0  L 192.168.2.1/32 is directly connected, GigabitEthernet0/0  192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks  C 192.168.3.0/30 is directly connected, GigabitEthernet0/1  L 192.168.3.2/32 is directly connected, GigabitEthernet0/1 |   **Task 4.10.** Testing   * + **PC0** and **PC1** can communicate   + **PC2** and **PC3** can communicate   + **PC1** can communicate with **Router0**   + **PC3** can communicate with **Router1**   + **Router1** can communicate with **Router0**   + **PC1** can communicate with **PC3**   + **PC0** can communicate with **PC2**   **Task 4.11.** Don’t make me give you -30 marks!   |  | | --- | | Because of Gateway | | Added the gateway 192.168.1.1 to PC 0 |  * + Why did the last test not work?   + What did you do to fix it?   **Task 5.** Now is time for showing off.   * + Add **Server1** to **Switch0**.   + Configure its Ethernet interface so it has a similar IP address to **PC0** & **PC1**   + Enable the Web (HTTP) service.   + Check that **PC3** can browse to the Web server.   + What are the Quick Links on the server home page?  |  | | --- | |  | |
| **Logbook activity 3 reflection questions:**  Answer the questions below in a maximum of two sentences, incorporating details from this lab.  **Task 1: Basic Network Setup**  What is the role of the switch in this basic topology?  Switch is basically a central point or works as hub to which multiple devices are connected. All the communications are passed through it. Switch records the ports to which computer are connected.  What would happen if the PCs were on different subnets? Would they be able to communicate?  Subnets are used to communicate between two PCs configured on a unique IP address range. PCs from different subnets need router to communicate.  Explain the process that takes place when one PC pings another.  When one PC pings another PC, it sends a packet of data to that other device to check connectivity. Then other PC responds back with another packet to the 1st PC to confirm the connectivity.  How did you identify the MAC addresses of the PCs? Why might this information be useful?  There are two ways to find MAC address in cisco. Either by moving the curser to the relevant PC and an information screen pops up where we can see MAC address, or we can find it from command prompt by typing “ipconfig /all”. I tried both the ways. MAC address is useful because it is unique address of a PC set by its manufacturer.  **Task 2: Extending the Topology**  What new challenges did you encounter when extending the topology?  Using command prompt of a PC within the network and how to communicate between two routers.  What is the role of a DHCP server, and why is it useful in a network?  DHCP server basically provides the automatic configuration of IP address, subnet mask, default gateway, DNS server and more on the different devices in a network. It is useful because it is fast, efficient, and accurate than status IP configuration.  How does the DHCP service affect the network configurations of PC2 and PC3?  DHCP automatically configure the IP address, subnet mask, default gateway and DNS server of PC2 and PC3.  What would be the implications if the DHCP server went down?  If the DHCP server goes down devices connection to the network will be broken. Administrator  May need to add static IP configuration on devices to make them connect to the network.  **Task 3: Further Extension with Routers**  What is the significance of a router in a network topology?  Router is a device that connects two or more networks. It provides the significant address of the network. It directs data within the LAN to the relevant PC or device.  Why do you think the interface lights changed from red to green after configuring the Gigabit interface?  Lights of interface tells the status of connection. If light is red, then connection is broken and if light is green then connection is stable or working. In router-to-router connection we used Gigabit for communication and when we entered the IP addresses in the relevant interface cable, interface light turned green.  In your own words, explain what a Default Gateway is. How does it facilitate network communication?  Network is like a house, devices and PCs are like rooms in that house and gateway is like the main door of that house and postal code of that house is the default gateway. So, gateway provides the pathway to different devices within that network and allow them to communicate with any other network if it is connected.  **Task 4: Complete Topology with Routers**  Why is a crossover cable used to connect the two routers?  Crossover cable is used to connect two similar devices either they are PCs or routers. The reason for using a crossover cable is that each device’s transmitter is connected directly to the other device’s receiver, allowing for two-way communication.  What did you observe in the routing table before and after configuring the static route?  Before configuration PCs couldn’t communicate between them. But when I configured them as per the address, they can ping with each other successfully.  What challenges did you encounter when configuring the routers to communicate with each other?  Not much, just configuring the DNS part was tricky.  Explain why the last test didn't work initially and what steps you took to rectify it.  Last test didn’t work because PC0 did not have any default gateway and couldn’t communicate with PC2. So, I added default gateway in the configuration of PC0.  **Task 5: Extended work**  What is the role of a web server in a network?  Role of web server is handling HTTP Requests, Processing Requests, Content Delivery, Handling Static and Dynamic Content, Hosting Websites and Applications, Managing Security, Load Balancing, Logging and Monitoring, Redirection and URL Routing.  How did you ensure that PC3 could browse to the Web server?  I have connected both the routers via routing as static to connect with each other’s network. So, PCs from both networks can communicate with the PC of other network. I entered the address of Server1 in the browser of PC3 to communicate with it.  What are the 'Quick Links' on the server home page, and what do they signify?  Quick Links on the server home page are **A small page, Copyrights, Image page, Image.**  **General Questions**  What was the most challenging part of this lab for you?  To identify that how will I browse the web server without any URL. Later, came to know that I can do it by IP address.  What did you find most interesting or surprising while completing the lab tasks?  I Came to know how networks connect with each other. And how the routers send message between two networks.  How has this lab improved your understanding of network configurations and topologies?  I have never tried configuration before this. It was really an interesting thing to do. Also, I got to know how networking works.  Are there any real-world applications or scenarios where you can see these skills being applied?  Yes. The network of two companies like a production company is connected with a security company and giving them access to make their network secure. |

**Logbook activity – 3 Marking Scheme:**

|  |  |
| --- | --- |
| **Description** | **Marks possible** |
| **Tasks** | **50** |
| Start a New Packet Tracer activity and connect two PCs and a switch | 5 |
| Extend the topology | 10 |
| Extend the topology with switches and routers | 10 |
| Complete the topology by connecting the two routers together | 20 |
| Time for showing off | 5 |
| **Reflection questions** | **50** |
| Basic Network Setup | 8 |
| Extending the Topology | 10 |
| Further Extension with Routers | 10 |
| Complete Topology with Routers | 10 |
| Extended work | 6 |
| General Questions | 6 |

# Logbook activity 4: IPv4 Network Address Calculations

## 1. Determine whether IP addresses are on same network

|  |  |  |
| --- | --- | --- |
| * + 1. You are configuring two PCs for your network. PC-A is given an IP address of 192.168.1.18, and PC-B is given an IP address of 192.168.1.24. Both PCs receive a subnet mask of 255.255.255.248. [25 marks]   What is the network address for PC-A?  Answer: 192.168.1.16  What is the network address for PC-B?  Answer: 192.168.1.24  Will these PCs be able to communicate directly with each other?  Answer: PC-A and PC-B have different network addresses, so they cannot communicate directly with each other. They need a router or a switch to connect them to the same network.  What is the highest address that can be given to PC-B that allows it to be on the same network as PC-A?  Answer: The highest address that can be given to PC-B that allows it to be on the same network as PC-A is 192.168.1.23   |  | | --- | | **EXPLANATION for a:**  I found it by using Bit wise AND operation:  IP address of PC-A: 192.168.1.18  Subnet mask: 255.255.255.248  Bitwise AND operation: 11000000.10101000.00000001.00010010  11111111.11111111.11111111.11111000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  11000000.10101000.00000001.00010000  Network address of PC-A: **192.168.1.16**  ---------------------------------------------------------------------------------------------------------------------  IP address of PC-B: 192.168.1.24  Subnet mask: 255.255.255.248  Bitwise AND operation: 11000000.10101000.00000001.00011000  11111111.11111111.11111111.11111000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  11000000.10101000.00000001.00011000  Network address of PC-B: **192.168.1.24**  ---------------------------------------------------------------------------------------------------------------------  Network address of PC-A: 192.168.1.16  Subnet mask: 255.255.255.248  Inverted subnet mask: 00000000.00000000.00000000.00000111  Bitwise OR operation: 11000000.10101000.00000001.00010000  00000000.00000000.00000000.00000111  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  11000000.10101000.00000001.00010111  Broadcast address of PC-A's network: **192.168.1.23**  Therefore, the highest address that can be given to PC-B that allows it to be on the same network as PC-A is **192.168.1.23**. |  * + 1. You are configuring two PCs for your network. PC-A is given an IP address of 10.2.0.25, and PC-B is given an IP address of 10.3.0.50. Both PCs receive a subnet mask of 255.255.0.0. [25 marks]   What is the network address for PC-A?  Answer: **10.2.0.0**​  What is the network address for PC-B?  Answer: **10.3.0.0​**  Will these PCs be able to communicate directly with each other?  Answer: PC-A and PC-B have different network addresses, so they cannot communicate directly with each other. They need a router or a switch to connect them to the same network.  What is the lowest address that can be given to PC-B that allows it to be on the same network as PC-A?  Answer: **10.2.0.1**   |  | | --- | | **EXPLANATION for b:**  IP address of PC-A​: 10.2.0.25  Subnet mask: 255.255.0.  Bitwise AND operation: 00001010.00000010.00000000.00011001  11111111.11111111.00000000.00000000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  00001010.00000010.00000000.00000000  Network address of PC-A: **10.2.0.0**​  IP address of PC-B​: 10.3.0.50  Subnet mask: 255.255.0.0  Bitwise AND operation: 00001010.00000011.00000000.00110010  11111111.11111111.00000000.00000000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  00001010.00000011.00000000.00000000  Network address of PC-B: **10.3.0.0​**​  To have PC-B on the same network as PC-A, we can change the third octet of PC-B's IP address to match PC-A's network address (10.2.0.x). The lowest address for PC-B on the same network would be **10.2.0.1** | |

## 2. Identify the default gateway address.

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| --- | --- | --- |
| Your company has a policy to use the first IP address in a network as the default gateway address. A host on the local-area network (LAN) has an IP address of 172.16.140.24 and a subnet mask of 255.255.192.0. [25 marks]  What is the network address for this network?  Answer: **172.16.128.0**  What is the default gateway address for this host?  Answer: **172.16.128.1**   |  | | --- | | **EXPLANATION for a:**  To determine the network address, performing Bitwise AND operation  IP address​: 172.16.140.24  Subnet mask: 255.255.192.0  Bitwise AND operation: 10101100.00010000.10001100.00011000  11111111.11111111.11000000.00000000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  10101100.00010000.10000000.00000000  Network address: **172.16.128.0​**​ Default gateway address for this network is **172.16.128.01** |   Your company has a policy to use the first IP address in a network as the default gateway address. You have been instructed to configure a new server with an IP address of 192.168.184.227 and a subnet mask of 255.255.255.248. [25 marks]  What is the network address for this network?  Answer: **192.168.184.224**  What is the default gateway for this server?  Answer: **192.168.184.224**   |  | | --- | | **EXPLANATION for b:**  To determine the network address, performing Bitwise AND operation  IP address​: 192.168.184.227  Subnet mask: 255.255.255.248  Bitwise AND operation: 11000000.10101000.10111000.11100011  11111111.11111111.11111111.11111000  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  11000000.10101000.10111000.11100000  Network address: **192.168.184.224**  Normally the default gateway is the first IP address in the network. For this network, **192.168.184.224** is the first address, which is the network address plus 1 which is **192.168.184.225**. | |
|  |

# Logbook activity 5: Subnetting Network Topologies

## 1. Calculate subnet information

Use the 192.168.2.0/24 network address to provide addresses to the network devices in the following network topology. Also provide an IP address scheme that will accommodate these additional devices. For this topology, assign a subnet to each network.

A picture containing text, clock

Description automatically generated

**Step 1: Determine the number of subnets in Network Topology C. [25 marks]**

1. How many subnets are there? 6
2. How many bits should you borrow to create the required number of subnets? 3
3. How many usable host addresses per subnet are in this addressing scheme? 30
4. What is the new subnet mask in dotted decimal format? 255.255.255.224
5. How many subnets are available for future use? 2

|  |
| --- |
| **EXPLANATION:**   1. There are 6 subnets in this network topology because we have 3 routers, and each network has 3 networks but 3 of all are common so total subnets are 6. 2. I borrowed 3 bits because if I borrow 2, I can create subnets up to 4 so for 6 subnets I borrowed 3 bits which allowed to create subnets up to 8 as per formula 23=8 3. The remaining host bits are 5 which we can have 30 usable hosts as per formula 25-2=30 4. The new subnet mask is 255.255.255.224 because we used first 3 bits of last octet which will be 11100000 and in decimal it is 224 so subnet mask ends up at 224. 5. We were allowed to create 8 subnets, but I created 6 so 2 subnets are available for future use. |

**Step 2: Record the subnet information. [25 marks]**

Fill in the following table with the subnet information:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet Number** | **Subnet Address** | **First Usable Host**  **Address** | **Last Usable Host**  **Address** | **Broadcast**  **Address** |
| 0 | 192.168.2.0 | 192.168.2.1 | 192.168.2.30 | 192.168.2.31 |
| 1 | 192.168.2.32 | 192.168.2.33 | 192.168.2.62 | 192.168.2.63 |
| 2 | 192.168.2.64 | 192.168.2.65 | 192.168.2.94 | 192.168.2.95 |
| 3 | 192.168.2.96 | 192.168.2.97 | 192.168.2.126 | 192.168.2.127 |
| 4 | 192.168.2.128 | 192.168.2.129 | 192.168.2.158 | 192.168.2.159 |
| 5 | 192.168.2.160 | 192.168.2.161 | 192.168.2.190 | 192.168.2.191 |
| 6 | 192.168.2.192 | 192.168.2.160 | 192.168.2.160 | 192.168.2.223 |
| 7 | 192.168.2.224 | 192.168.2.160 | 192.168.2.160 | 192.168.2.255 |

|  |
| --- |
| **EXPLANATION:**  Since our network address is 192.168.2.0 so if we convert it into binary, it will be:  192.168.2.0 = 11000000.10101000.00000010.00000000  NETWORK HOST  I borrowed 3 bits from host octet, so remaining bits for hosts are 5.  For subnetting I added 1 in the borrowed bit for each new subnet  Network  1st Subnet 11000000.10101000.00000010.000000000 = 192.168.2.0  **+1**  **--------------------------------------------------------**  2nd Subnet 11000000.10101000.00000010.00100000 = 192.168.2.32  So, in 1st subnet address, 1st usable host address is 192.168.2.1, last usable host address is 192.168.2.30 and broadcast address is 192.168.2.31  For 3rd Subnet address  2nd Subnet 11000000.10101000.00000010.00100000 = 192.168.2.32  **+1**  **--------------------------------------------------------**  3rd Subnet 11000000.10101000.00000010.001000000 = 192.168.2.64  Just like this I found all next subnet addresses. I was meant to find just 6 but I also added 2 more in the table. |

**Step 3: Assign addresses to network devices in the subnets. [50 marks]**

1. Fill in the following table with IP addresses and subnet masks for the router interfaces:

|  |  |  |  |
| --- | --- | --- | --- |
| **Device** | **Interface** | **IP Address** | **Subnet Mask** |
| R1 | GigabitEthernet 0/1 | 192.168.2.1 | 255.255.255.224 |
|  | Serial 0/0/0 | 192.168.2.33 | 255.255.255.224 |
|  | Serial 0/0/1 | 192.168.2.65 | 255.255.255.224 |
| R2 | GigabitEthernet 0/1 | 192.168.2.97 | 255.255.255.224 |
|  | Serial 0/0/0 | 192.168.2.34 | 255.255.255.224 |
|  | Serial 0/0/1 | 192.168.2.129 | 255.255.255.224 |
| R3 | GigabitEthernet 0/1 | 192.168.2.161 | 255.255.255.224 |
|  | Serial 0/0/0 | 192.168.2.66 | 255.255.255.224 |
|  | Serial 0/0/1 | 192.168.2.130 | 255.255.255.224 |

|  |
| --- |
| **EXPLANATION:**  As I have already discussed above that new subnet mask is 255.255.255.224 because we used first 3 bits of last octet which will be 11100000 and in decimal it is 224 so subnet mask ends up at 224.  As 6 subnets addresses were required to find so after finding it,   1. I assigned the **1st** usable host address of **1st** subnetwork to the “**GigabitEthernet 0/1**” of router 1 (R1) which is **192.168.2.1**. 2. I assigned the **1st** usable host address of **2nd** subnetwork to the “**Serial 0/0/0**” of router 1 (R1) which is **192.168.2.33**. 3. I assigned the **2nd** usable host address of **2nd** subnetwork to the “**Serial 0/0/0**” of router 2 (R2) which is **192.168.2.34**. 4. I assigned the **1st** usable host address of **3rd** subnetwork to the “**Serial 0/0/1**” of router 1 (R1) which is **192.168.2.65**. 5. I assigned the **2nd** usable host address of **3rd** subnetwork to the “**Serial 0/0/0**” of router 3 (R3) which is **192.168.2.66**. 6. I assigned the **1st** usable host address of **4th** subnetwork to the “**GigabitEthernet 0/1**” of router 2 (R2) which is **192.168.2.97**. 7. I assigned the **1st** usable host address of **5th** subnetwork to the “**Serial 0/0/1**” of router 2 (R2) which is **192.168.2.129**. 8. I assigned the **2nd** usable host address of **5th** subnetwork to the “**Serial 0/0/1**” of router 3 (R3) which is **192.168.2.130**. 9. I assigned the **1st** usable host address of **6th** subnetwork to the “**GigabitEthernet 0/1**” of router 3 (R3) which is **192.168.2.161**. |
|  |

1. Fill in the following table with the IP addresses and subnet masks for devices in the LAN as displayed in topology.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device** | **Interface** | **IP Address** | **Subnet Mask** | **Default Gateway** |
| PC-A | NIC | 192.168.2.30 | 255.255.255.224 | 192.168.2.1 |
| PC-B | NIC | 192.168.2.29 | 255.255.255.224 | 192.168.2.1 |
| S1 | VLAN 1 | 192.168.2.2 | 255.255.255.224 | 192.168.2.1 |
| PC-C | NIC | 192.168.2.126 | 255.255.255.224 | 192.168.2.97 |
| PC-D | NIC | 192.168.2.125 | 255.255.255.224 | 192.168.2.97 |
| S2 | VLAN 1 | 192.168.2.98 | 255.255.255.224 | 192.168.2.97 |
| PC-E | NIC | 192.168.2.190 | 255.255.255.224 | 192.168.2.161 |
| PC-F | NIC | 192.168.2.189 | 255.255.255.224 | 192.168.2.161 |
| S3 | VLAN 1 | 192.168.2.162 | 255.255.255.224 | 192.168.2.161 |

|  |
| --- |
| **EXPLANATION:**  Subnet mask for all the subnetworks is same because we borrowed 3 bits from host address.  We have three subnets in total so in **1st** network:  Default gateway is 192.168.2.1.  I assigned 1st available host address to Switch with (VLAN 1) interface which is 192.168.2.2. And I assigned last two available host addresses to PC-A and PC-B which are 192.168.2.30 and 192.168.2.29 respectively.  In **2nd** Network:  Default gateway is 192.168.2.97.  I assigned 1st available host address to Switch with (VLAN 1) interface which is 192.168.2.98. And I assigned last two available host addresses to PC-C and PC-D which are 192.168.2.126 and 192.168.2.125 respectively.  In **3rd** network:  Default gateway is 192.168.2.162.  I assigned 1st available host address to Switch with (VLAN 1) interface which is 192.168.2.2. And I assigned last two available host addresses to PC-E and PC-F which are 192.168.2.190 and 192.168.2.189 respectively. |

# Logbook activity 6: VLSM Design and Implementation Practice

**Objectives**

**Part 1: Examine the Network Requirements**

**Part 2: Design the VLSM Addressing Scheme**

**Part 3: Assign IP Addresses to Devices and Verify Connectivity**

**Background**

In this activity, you are given a /24 network address to use to design a VLSM addressing scheme. Based on a set of requirements, you will assign subnets and addressing, configure devices and verify connectivity.

Create the following network topology.

**Network Topology:**

Diagram

Description automatically generated

## Part 1. Examine the Network Requirements

### Step 1. Determine the number of subnets needed.

You will subnet the network address 172.31.103.0/24. The network has the following requirements:

* SW-1 LAN will require 27 host IP addresses.
* SW-2 LAN will require 25 host IP addresses.
* SW-3 LAN will require 14 host IP addresses.
* SW-4 LAN will require 8 host IP addresses.

**Question:**

How many subnets are needed in the network topology?

[5]

### Step 2. Determine the subnet mask information for each subnet.

**Questions:**

* + - * 1. Which subnet mask will accommodate the number of IP addresses required for SW-1?

The subnet mask for SW-1 is 255.255.255.224 (or /27 in CIDR notation).

How many usable host addresses will this subnet support?

[30]

* 1. Which subnet mask will accommodate the number of IP addresses required for SW-2?

The subnet mask for SW-2 is 255.255.255.224 (or /27 in CIDR notation).

How many usable host addresses will this subnet support?

[30]

* 1. Which subnet mask will accommodate the number of IP addresses required for SW-3?

The subnet mask for SW-2 is 255.255.255.240 (or /28 in CIDR notation).

How many usable host addresses will this subnet support?

[14]

* 1. Which subnet mask will accommodate the number of IP addresses required for SW-4?

The subnet mask for SW-2 is 255.255.255.240 (or /28 in CIDR notation).

How many usable host addresses will this subnet support?

[14]

* 1. Which subnet mask will accommodate the number of IP addresses required for the connection between Building-1 and Building-2?

The subnet mask for Building-1 and building-2 is 255.255.255.252 (or /30 in CIDR notation).

## Part 2. Design the VLSM Addressing Scheme

### Step 1. Divide the 172.31.103.0/24 network based on the number of hosts per subnet.

Now fill in the following summary table with the VLSM subnet information:

**VLSM Summary Table:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Subnet Number** | **Subnet address/CIDR** | **Subnet Mask** | **First Usable  Host Address** | **Broadcast Address** | **Usable Hosts** |
| 0 | /27 | 255.255.255.224 | 172.31.103.1 | 172.31.103.31 | 30 |
| 1 | /27 | 255.255.255.224 | 172.31.103.33 | 172.31.103.63 | 30 |
| 2 | /28 | 255.255.255.240 | 172.31.103.65 | 172.31.103.79 | 14 |
| 3 | /28 | 255.255.255.240 | 172.31.103.81 | 172.31.103.95 | 14 |
| 4 | /30 | 255.255.255.252 | 172.31.103.97 | 172.31.103.99 | 2 |

### Step 2. Document the VLSM subnets.

Complete the **Subnet Table**,listing the subnet descriptions, number of hosts needed, then network address for the subnet, the first usable host address, and the broadcast address. Repeat until all addresses are listed.

1. Use the first subnet to accommodate the largest LAN.
2. Use the second subnet to accommodate the second largest LAN.
3. Use the third subnet to accommodate the third largestLAN.
4. Use the fourth subnet to accommodate the fourth largestLAN.
5. Use the fifth subnet to accommodate the connection between Building-1and Building-2.

**VLSM Subnet Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subnet Description** | **Number of Hosts  Needed** | **Network Address/CIDR** | **First Usable Host Address** | **Broadcast Address** |
| Host-A LAN | 27 | 172.31.103.0/27 | 172.31.103.1 | 172.31.103.31 |
| Host-B LAN | 25 | 172.31.103.32/27 | 172.31.103.33 | 172.31.103.63 |
| Host-C LAN | 14 | 172.31.103.64/28 | 172.31.103.65 | 172.31.103.79 |
| Host-D LAN | 8 | 172.31.103.80/28 | 172.31.103.81 | 172.31.103.95 |
| WAN Link | 2 | 172.31.103.96/30 | 172.31.103.97 | 172.31.103.99 |

### Step 3. Document the addressing scheme.

1. Assign the first usable IP addresses to Building-1 for the two LAN links.
2. Assign the first usable IP addresses to Building-2 for the two LAN links.
3. Assign the IP addresses to the WAN link.
4. Assign the second usable IP addresses to the switches.
5. Assign the last usable IP addresses to the hosts.

**Addressing Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device** | **Interface** | **IP Address** | **Subnet Mask** | **Default Gateway** |
| Building-1 | G0/0 | 172.31.103.1 | 255.255.255.224 | N/A |
| G0/1 | 172.31.103.33 | 255.255.255.224 | N/A |
| S0/0/0 | 172.31.103.97 | 255.255.255.252 | N/A |
| Building-2 | G0/0 | 172.31.103.65 | 255.255.255.240 | N/A |
| G0/1 | 172.31.103.81 | 255.255.255.240 | N/A |
| S0/0/0 | 172.31.103.98 | 255.255.255.252 | N/A |
| SW-1 | VLAN 1 | 172.31.103.2 | 255.255.255.224 | 172.31.103.1 |
| SW-2 | VLAN 1 | 172.31.103.34 | 255.255.255.224 | 172.31.103.33 |
| SW-3 | VLAN 1 | 172.31.103.66 | 255.255.255.240 | 172.31.103.65 |
| SW-4 | VLAN 1 | 172.31.103.82 | 255.255.255.240 | 172.31.103.81 |
| Host-A | NIC | 172.31.103.30 | 255.255.255.224 | 172.31.103.1 |
| Host-B | NIC | 172.31.103.62 | 255.255.255.224 | 172.31.103.33 |
| Host-C | NIC | 172.31.103.78 | 255.255.255.240 | 172.31.103.65 |
| Host-D | NIC | 172.31.103.94 | 255.255.255.240 | 172.31.103.81 |

## Part 3. Assign IP Addresses to Devices and Verify Connectivity

Choose Option 1, if you are using given topology. Choose Option 2, if you are creating your own topology. Use Command Line Interface to configure devices.

**Example Configuration:**

|  |
| --- |
| You have used GUI to configure router before. Now use CLI to configure router. Use below example.  Building-Router:  Router>en // User EXEC mode; View-only mode  Router#conf t // Privileged EXEC mode; The user can use this for any  // monitoring commands and execute configuration and  // management commands.  Router(config)#int g0/0 // global configuration mode  Router(config-if)#ip add <ip-address> <subnet-mask> // interface  // configuration  // mode  Router(config-if)#no shut // enable the interface  Router(config-if)#int g0/1  Router(config-if)#ip add <ip-address> <subnet-mask>  Router(config-if)#no shut    To access the switch remotely, an IP address and a subnet mask must be configured on the Switch Virtual Interface (SVI). To configure an SVI on a switch, use the interface vlan 1 global configuration command. Vlan 1 is not an actual physical interface but a virtual one. Next assign an IPv4 address using the **ip address <ip-address> <subnet-mask>** interface configuration command. Finally, enable the virtual interface using the **no shutdown** interface configuration command.  After these commands are configured, the switch has all the IPv4 elements ready for communication over the network.  Note: Similar to a Windows hosts, switches configured with an IPv4 address will typically also need to have a default gateway assigned. This can be done using the **ip default-gateway <ip-address>** global configuration command. The ip-address parameter would be the IPv4 address of the local router on the network.  Use the below example to configure switches using CLI  LAN-Switch:  Switch>en  Switch#conf t  Switch(config)#int vlan 1  Switch(config-if)#ip add <ip-address> <subnet-mask>  Switch(config-if)#no shut  Switch(config-if)#ip def <default-gateway-address> |

Implement the following steps to complete the addressing configuration.

### Step 1: Configure Building-1 router LAN and WAN interfaces.

|  |
| --- |
| Building-1 configuration:  Router>enable  Router#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Router(config)#interface GigabitEthernet0/0  Router(config-if)#ip address 172.31.103.1 255.255.255.224  Router(config-if)#no shutdown  Router(config-if)#  %LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up  Router(config-if)#interface GigabitEthernet0/1  Router(config-if)#ip address 172.31.103.33 255.255.255.224  Router(config-if)#no shutdown  Router(config-if)#  %LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up  Router(config-if)#interface Serial0/0/0  Router(config-if)#ip address 172.31.103.97 255.255.255.252  Router(config-if)#no shutdown  %LINK-5-CHANGED: Interface Serial0/0/0, changed state to down  Router(config-if)#end  Router#  %SYS-5-CONFIG\_I: Configured from console by console  Router#exit  Router con0 is now available  Press RETURN to get started.  Router>enable  Router#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Router(config)#ip route 172.31.103.64 255.255.255.240 172.31.103.98  Router(config)#ip route 172.31.103.80 255.255.255.240 172.31.103.98  Router(config)#end  Router#  %SYS-5-CONFIG\_I: Configured from console by console |

### Step 2: Configure Building-2 router LAN and WAN interfaces.

|  |
| --- |
| Building-2 configuration:  Router>enable  Router#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Router(config)#interface GigabitEthernet0/0  Router(config-if)#ip address 172.31.103.65 255.255.255.240  Router(config-if)#no shutdown  Router(config-if)#  %LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up  Router(config-if)#interface GigabitEthernet0/1  Router(config-if)#ip address 172.31.103.81 255.255.255.240  Router(config-if)#no shutdown  Router(config-if)#  %LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up  Router(config-if)#interface Serial0/0/0  Router(config-if)#ip address 172.31.103.97 255.255.255.252  Router(config-if)#no shutdown  %LINK-5-CHANGED: Interface Serial0/0/0, changed state to down  Router(config-if)#end  Router#  %SYS-5-CONFIG\_I: Configured from console by console  Router#exit  Router con0 is now available  Press RETURN to get started.  Router>enable  Router#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Router(config)#ip route 172.31.103.0 255.255.255.224 172.31.103.97  Router(config)#ip route 172.31.103.32 255.255.255.224 172.31.103.97  Router(config)#end  Router#  %SYS-5-CONFIG\_I: Configured from console by console |

### Step 3: Configure SW-1, SW-2, and SW-3 switches including the default gateway.

|  |
| --- |
| SW-1 configuration:  Switch>enable  Switch#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Switch(config)#interface Vlan1  Switch(config-if)#ip address 172.31.103.2 255.255.255.224  Switch(config-if)#no shutdown  %LINK-5-CHANGED: Interface Vlan1, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up  Switch(config-if)#ip default-gateway 172.31.103.1  Switch(config)#end  Switch#  %SYS-5-CONFIG\_I: Configured from console by console |

|  |
| --- |
| SW-2 configuration:  Switch>enable  Switch#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Switch(config)#interface Vlan1  Switch(config-if)#ip address 172.31.103.34 255.255.255.224  Switch(config-if)#no shutdown  %LINK-5-CHANGED: Interface Vlan1, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up  Switch(config-if)#ip default-gateway 172.31.103.33  Switch(config)#end  Switch#  %SYS-5-CONFIG\_I: Configured from console by console |

|  |
| --- |
| SW-3 configuration:  Switch>enable  Switch#configure  Configuring from terminal, memory, or network [terminal]? terminal  Enter configuration commands, one per line. End with CNTL/Z.  Switch(config)#interface Vlan1  Switch(config-if)#ip address 172.31.103.66 255.255.255.240  Switch(config-if)#no shutdown  %LINK-5-CHANGED: Interface Vlan1, changed state to up  %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up  Switch(config-if)#ip default-gateway 172.31.103.65  Switch(config)#end  Switch#  %SYS-5-CONFIG\_I: Configured from console by console |

### Step 4: Configure Host-A, Host-B, Host-C, and Host-D, hosts including the default gateway.

|  |
| --- |
| Host-A  IP address: 172.31.103.30 Subnet Mask: 255.255.255.224 Default gateway: 172.31.103.1 |

|  |
| --- |
| Host-B  IP address: 172.31.103.62 Subnet Mask: 255.255.255.224 Default gateway: 172.31.103.33 |

|  |
| --- |
| Host-C  IP address: 172.31.103.78 Subnet Mask: 255.255.255.240 Default gateway: 172.31.103.65 |

|  |
| --- |
| Host-D  IP address: 172.31.103.94 Subnet Mask: 255.255.255.240 Default gateway: 172.31.103.81 |

## Part 4: Verify connectivity.

Verify connectivity from all hosts. If you successfully configure all devices, you should be able to ping every IP address listed in the **Addressing Table**. Show your successful test using a screenshot. If ping does not work, explain why? What have you done to fix it?

|  |
| --- |
| **Explanation:** All tests are successful, and ping is working properly. Reference in the screenshots |

**Logbook Activity – 6 Marking Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tasks** | **Subtasks** | **Description** | **Criteria for Full Marks** | **Marks Possible** |
| Part 1: Examine the Network Requirements | Step 1: Determine the number of subnets needed. | Number of subnets needed based on network requirements | Correctly determined the number of subnets needed | 5 |
| Step 2: Determine the subnet mask information for each subnet. | Subnet mask for SW-1, SW-2, SW-3, SW-4 | Correctly identified the subnet masks for all LANs | 10 |
| Part 2: Design the VLSM Addressing Scheme | Step 1: Divide the given network based on the number of hosts per subnet. | Completed VLSM Summary Table | All entries in the VLSM Summary Table are correct | 8 |
| Step 2: Document the VLSM subnets. | Completed VLSM Subnet Table | All entries in the VLSM Subnet Table are correct | 10 |
| Step 3: Document the addressing scheme. | Completed Addressing Table | All entries in the Addressing Table are correct | 14 |
| Part 3: Assign IP Addresses to Devices and Verify Connectivity | Step 1: Configure IP addressing on the Building-1 router LAN and WAN interfaces. | Commands for Building-1 configuration | Correct commands and IP addresses for Building-1 | 5 |
| Step 2: Configure IP addressing on the Building-2 router LAN and WAN interfaces. | Commands for Building-2 configuration | Correct commands and IP addresses for Building-2 | 5 |
| Step 3: Configure IP addressing on the SW-1, SW-2, and SW-3 switches including the default gateway. | Commands for switches configuration | Correct commands and IP addresses for switches | 15 |
| Step 4: Configure IP addressing on the Host-A, Host-B, Host-C, and Host-D, hosts including the default gateway. | Commands for Hosts configuration | Correct commands and IP addresses for hosts | 8 |
| Part 4: Verify Connectivity | N/A | Screenshot showing successful ping tests and explanation | Screenshot verifies that all devices can communicate, with sufficient explanation and appropriate configuration commands | 20 |

**Logbook Marking Scheme:**

|  |  |
| --- | --- |
| **Logbook activity** | **Marks possible** |
| 1 | 10% |
| 2 | 10% |
| 3 | 20% |
| 4 | 10% |
| 5 | 10% |
| 6 | 30% |
| Overall impression | 10% |