

## **CN5002/CD5002 Coursework (Part 1)**

### **Analysis and Design of a Computer Network using Cisco Packet Tracer**

#### **Aim**

Computation and allocation of IP addresses to devices in a computer network (based on a given block IP address), followed by design and simulation of the network using Cisco Packet Tracer software.

#### **1. Deadline**

- **Friday 26 April 2024: Submissions of Packet Tracer file and report via Moodle**

#### **2. Coursework Requirement**

Each student must use his/her student's number and the algorithm given below to determine a block IP address. Each student must then allocate an IP address to devices in the given scenario and configure the network using Cisco Packet Tracer software. This must be followed by simulation of the designed network and usage of debugging techniques (i.e., PDU or Ping command) to ensure satisfactory operation of all devices on the network.

##### **2.1 Algorithm to Determine Each Student's Block IP Address**

Each student's ID number uxxxxxxx must be converted into the format xxx.xx.xx.0/25 by applying the following procedure to obtain the student's block IP address and mask:

Use your student's number to create your individual block IP address as follows:

##### **First section of IP**

1. If the first three digits is less than 224 then take the first three digits as the first section of IP address.
2. If the first three digits is more than 223, then take 193 as the first section of IP address.

##### **Second section of IP**

1. Take the next 2 digits (digit 4<sup>th</sup> and 5<sup>th</sup> of your student number) for the second section of the IP address;
2. If both are 0s (zeros) replace them by 11 and if only the digit 4<sup>th</sup> is 0 then ignore it (i.e. do not include it in your IP address).

#### Third section of IP

1. For the third section of the IP address, take the following 2 digits (digit 6<sup>th</sup> and 7<sup>th</sup>);
2. If both are 0s (zeros) replace them by 11 and if only the 6<sup>th</sup> digit is 0 then ignore it (i.e. do not include it in the IP address).

#### Fourth section of IP

1. The last section of the IP address must be zero Mask
2. Finally, the mask is /25.

#### **NOTE:**

1. It is the responsibility of each student to conduct research to check and confirm that their Block of IP address is not private or reserved.
2. The module teaching team must confirm your block of IP address and mask before proceeding to the next stage of the coursework.

### 3. Activities to be carried out in the Coursework

Use the Cisco Packet Tracer and the information below to analyse and create a small network. This requires connecting the network devices given below and configuring the active nodes (i.e., host computers, routers etc.) to form network connectivity.

The given devices are listed below with the subnet details in Table 1:

- Cisco Routers
- Cisco Switches
- Computers (hosts), see Table 1
- Servers
- Connecting cables, see Table 3

Table 1

Subnets	Number of Hosts
Subnet A	No computer
Subnet B	No computer
Subnet C	No computer
Subnet D	1 server and 4 computers
Subnet E	1 server and 18 computers
Subnet F	1 server and 20 computers

#### Task 3.1 Analysis and Design of the Logical Network

Compute and determine the Network Address, Address Mask, Subnetting and other addresses in Table 2 using lecture materials and information from the recommended textbook as a guide.

**Task: 3.1.1:** - Using the classless IP address computation techniques and block IP address and mask xxx.xx.xx.0/25 (address / mask) you obtained from Task 2.1 perform the following tasks:

- Determine the number of addresses in the network
- Last Host Address, the Broadcast and the Bit mask etc.
- Complete Table 2 below for each subnet A, B, C, D, E, and F.

Conduct the above calculation for your IP addresses and design an IP address scheme that satisfies the requirements in Table 1 above.

- Show the step by step procedure you used to complete Table 2 below.
- Hints: - for the classless computation use either the binary or AND/OR approach or any other method in the recommended textbook/lectures.
- Students are required to show and explain steps used for IP calculation.
- For the sub-netting computation use the technique in the recommended textbook or any acceptable method and explain the procedure used.

**Task: 3.1.2: - Table 2**

Subnet	Network Address	Mask	First Host Address	Last Host Address	Broadcast	Bit mask
A						
B						
C						
D						
E						
F						

- For the coursework, the designed network must be implemented in the Packet Tracer software.

#### 4. Configure the Physical topology

##### Task 4.1

- a. Use ALL the above devices and design a network topology. The network topology must be drawn and developed in the Cisco Packet Tracer Software and saved as Network\_uXXXXXXXX.pkt – where uXXXXXXXX is your student number.
- b. Indicate the types of cables you used for each connection between devices and subnets in your network (example: Host1 - Router: name of the cable). This question should be answered in the Table 3 below:

Table 3

	Type of cable used
1. Between Routers and Switches	
2. Between Routers	
3. Between Routers and Hosts (PCs)	
4. Between Routers and Switches	
5. Between Switches	
6. Between Switches and servers	

## 5. Configure the Logical Topology

From the IP address Information recorded in Table 2, write down the IP address information for each computer or Host listed in Table 4 below:

- **Complete the Table 4 below for Network D**
- **Using Table 4 below as a guide to create and complete similar tables for Network E and Network F**

Table 4: Network D

Host 1	
IP Address	
IP Mask	
Gateway Address	

Host 2	
IP Address	
IP Mask	
Gateway Address	

Host 3	
IP Address	
IP Mask	
Gateway Address	

Host 4	
IP Address	
IP Mask	
Gateway Address	

Server	
IP Address	
IP Mask	
Gateway Address	

## **6. Security Systems on the Routers and Active Devices:**

Setup the following security passwords:

- o The Telnet password;
  - o The Aux port password;
  - o Console password;
  - o Enable password;
- Explain the steps you used to set up the above security systems.
- Use screen shots from the implementation to illustrate your work.

## 7. Connectivity Verification of all Devices Including Routers and Switches

1. Verification of Network Connectivity.
2. **NO MARKS WILL BE GIVEN IF THERE IS NO EVIDENCE OF SCREEN CAPTURES).**

Use any one of the debugging commands discussed in lecture (or practical sessions) to verify that all devices have been configured.

Use the Table 5 below, to methodically verify and record the results of connectivity between the devices. In the column “Results” enter either an “S” where there is connectivity or an “F” where there is no connectivity.

Table 5

From	To	IP Address	Results
Host 1	Gateway (Router 1, Fa0/0)		
Host 1	Router 1, Fa0/1		
Host 1	Host 2		
Host 1	Host 3		
Host 1	Host 4		
Host 1	Server		
Host 2	Gateway (Router 1, Fa0/0)		
Host 2	Router 1, Fa0/1		
Host 2	Host 1		
Host 2	Server		
Host 3	Gateway (Router 2, Fa0/0)		
Host 3	Router 2, Fa0/1		
Host 3	Host 1		
Host 4	Gateway (Router 2, Fa0/0)		
Host 4	Router 2, Fa0/1		
Host 4	Host 2		
Server	Gateway (Router 2, Fa0/0)		
Server	Router 1, Fa0/1		
Server	Router 2, Fa0/1		
Server	Host 2		



**NOTE:**

To have successful design of the network you must also implement DHCP and RIP Configurations correctly.

**8. Submission of work**

Two files must be submitted as the outcome of your project:

- Design a network topology using information given in this document. The network topology must be drawn and developed in the Cisco Packet Tracer Software package and save as Network\_uXXXXXXXX.pkt – where uXXXXXXXX is your student no.
- Write a report in Word based on the following guidelines and save it as Report\_uXXXXXXXX.doc – where uXXXXXXXX is your student no.

**8.1 Documentation guidelines**

- An individual report of 2,000 +/- 10% words, excluding the diagrams, illustrations and references, are required.
- The structure of the report should include the following sections:
  - o Title
  - o Introduction
  - o Objectives and overview of the coursework;
  - o Design and build computer network using Packet Tracer.
  - o Simulate the designed computer network using Packet Tracer.
  - o Capture the simulation results
  - o Evaluate the designed network and results of the simulation
  - o Conclusion
  - o References, presentation and Appendices etc.
- You need to write a comprehensive report which also includes answers to all the tasks mentioned in this document. Please indicate and bold the task number wherever you answer a task in the report.

### NOTE

1. Question 1 Task 1: after allocating IP addresses, fill them in Table 2 above and insert the table in your report.
2. Question 2 Task 2: Your topology must be saved as a packet tracer file with extension. pkt (Network\_u1339611.pkt) and be uploaded to the Turnitin in Moodle.
3. Question 3 Task 3: Types of cables used for connection between devices and subnets must be indicated. Complete Table 3 and insert it in the report. Host names on the table should correspond to the host names on your packet tracer file. Please make sure that your file is saved after all devices have been configured.
4. Question 4: Complete Table 4 above on this document and insert it in the report. The evidence of connectivity (results) of this question must be saved in the report.
5. Please follow instructions below:
  - a. Maximize the command prompt screen
  - b. Verify two connectivities each time, press PrtScr and paste it in the report file. Please indicate the name of the host (HOST1, HOST2 or HOST3) for each screen dump. At the end you will have 10 screens, which must be big enough to show commands and results. (See Figure 2: Sample 2)
  - c. Repeat the same verification using PDU. At end of all 20 verifications, double click on PDU List Window to make it bigger. Capture the screen by pressing PrtScr and paste it onto the report file. (See Figure 1: Sample 1)

## Samples of screen shots to be uploaded:

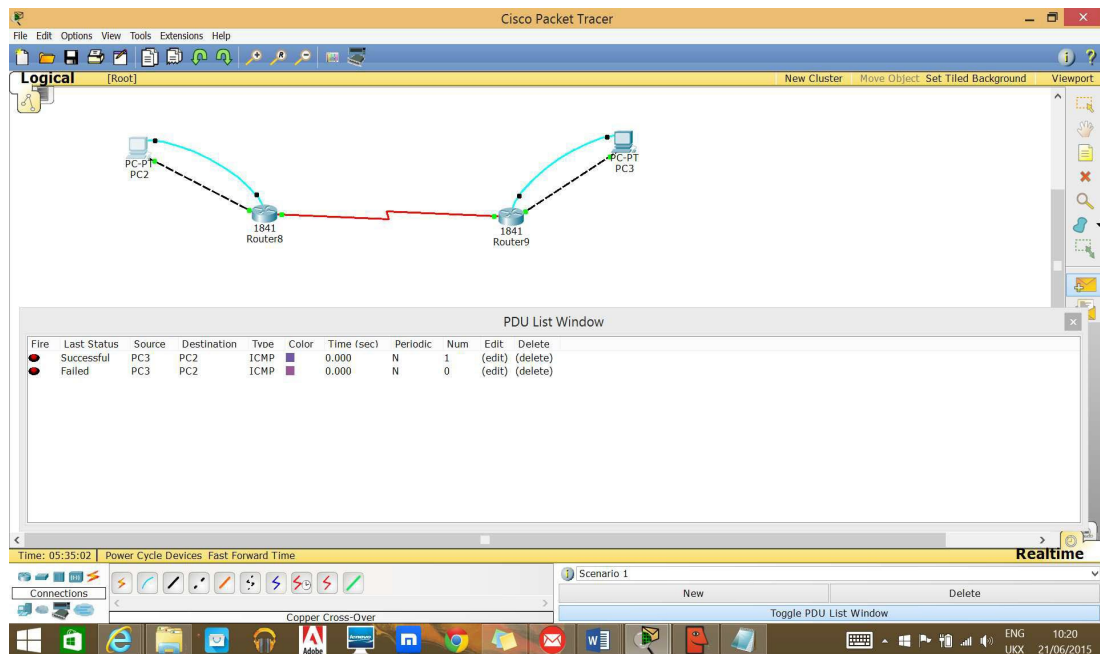


Figure 1: Sample 1 an example of screenshot of network from Packet Tracer

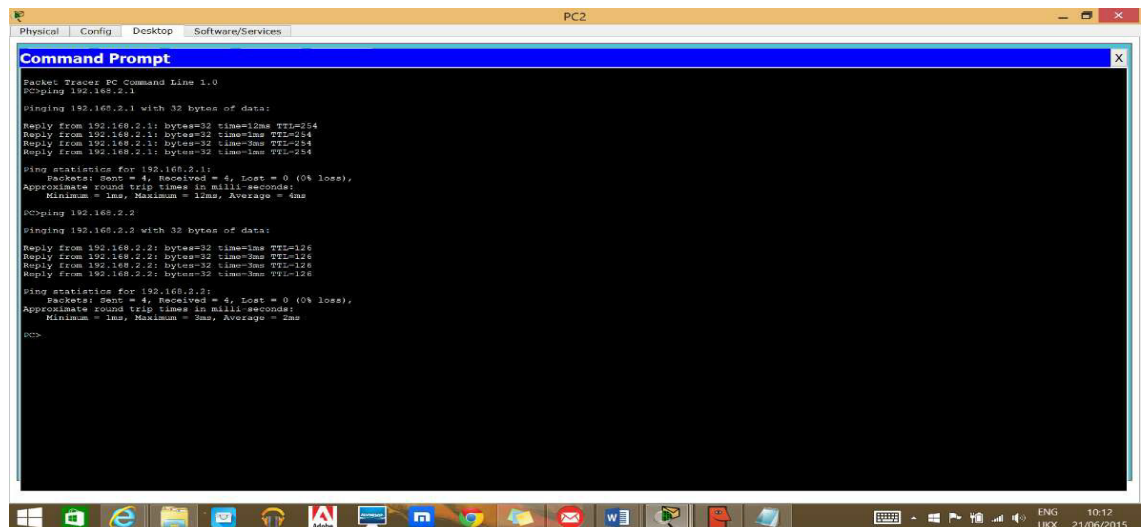


Figure 2: Sample 2 is an example of screen shot for HOST 1

## 9. Submission Deadline

Each student must submit the report part of the coursework and the practical work (packet tracer file) via the Turnitin link on Moodle before or by 28 April 2023.

The Turnitin link on Moodle has two tabs called “Report” and “Packet Tracer File”. The report with extension .doc must be uploaded in the “Report” tab (See Figure 3). The Cisco Packet Tracer file with extension .pkt must be uploaded in the “Packet Tracer File” tab (See Figure 4).




<div>Report</div> <div>Packet Tracer File</div>		
Title	Start Date	Due Date
Coursework Report and Packet Trace File Submission Link - Report 	25 Apr 2024 - 00:01 	26 Apr 2024 - 23:59 

Figure 3




<div>Report</div> <div>Packet Tracer File</div>		
Title	Start Date	Due Date
Coursework Report and Packet Trace File Submission Link  Packet Tracer File	25 Apr 2024 - 00:01 	26 Apr 2024 - 23:59 

Figure 4

## **10. Rules**

1. The report must not exceed 2000 +/- 10% words; diagrams will not be included in the word count.
2. All materials must be original in the sense that you prepared them.
3. The work must demonstrate that you have read at least eight named primary resources, and at least three must be publications that are not older than three years.
4. At least 25% of the work must demonstrate your views in the form of discussion and conclusions.
5. All works must demonstrate an appropriate level of English language and grammar as a basic prerequisite of passing the assessment.
6. All sources must be declared. Failure to state the source of any part will be penalised according to the University's regulations.
7. There should be a full reference list at the end of the report and upload an e-copy to Moodle.

**11. Marking Criteria**

Aspect of Coursework	Maximum Mark
<b>Introduction</b> Explaining the relevant theoretical concepts	5
<b>Objectives</b> Stating the tasks that need to be carried out to meet the aims of the coursework.	5
<b>Design</b> Identifying the required topology of the network including IP allocation and subnetting, network devices and cabling	25
<b>Simulation</b> Simulating the designed network using Packet Tracer.	15
<b>Results &amp; Analysis</b> Capturing all the required simulation results and analysing and interpreting simulation results.	20
<b>Evaluation</b> Reflecting on the coursework, assessing its successes, and identifying any required changes.	15
<b>Conclusion</b> Indicating the extent to which the aims were achieved and summarising the key features of the design.	10
<b>Presentation of the report</b> Compliance with standards of report writing (inclusion of title page, table of contents, figure labelling and citing references using Harvard system)	5