

# Computer Networks

## Complex Computing Problem

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**Topic: Efficient Subnetting Plan for University Network**

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Relevant Material:  [Shared Folder Link](#)

# Efficient IP Addressing and Subnetting Plan for University Network

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## Overview

I have to design an IP addressing and subnetting plan for a university with eight departments, using the 20.20.10.0/22 (1024 addresses). The goal is to use Variable Length Subnet Masking (VLSM) for efficient utilization, future scalability, and minimal wastage.

## Department Size Estimation

Assuming typical university needs and future growth, we categorize departments as:

**Large:** Computer Science

**Medium:** Electrical Engineering, Mechanical Engineering, Civil Engineering, Library

**Small:** Admin Office, Hostel, faculty

## Subnet Allocation Table

Department Name	Subnet ID	Subnet Mask	Broadcast Address	Host Bits	Total Hosts	Usable Hosts	Usable Range
Computer Science (CS)	20.20.8.0/24	255.255.255.0	20.20.8.255	8	256	254	20.20.8.1 – 20.20.8.254
Electrical Engg.	20.20.9.0/25	255.255.255.128	20.20.9.127	7	128	126	20.20.9.1 – 20.20.9.126
Library	20.20.9.128/25	255.255.255.128	20.20.9.255	7	128	126	20.20.9.129 – 20.20.9.254
Mechanical Engg	20.20.10.0/25	255.255.255.128	20.20.10.127	7	128	126	20.20.10.1 – 20.20.10.126
Civil Engg.	20.20.10.128/25	255.255.255.128	20.20.10.255	7	128	126	20.20.10.129 – 20.20.10.254
Hostel	20.20.11.0/26	255.255.255.192	20.20.11.63	6	64	62	20.20.11.1 – 20.20.11.62
Admin Office	20.20.11.64/26	255.255.255.192	20.20.11.127	6	64	62	20.20.11.65 – 20.20.11.126
Faculty Block	20.20.11.128/26	255.255.255.192	20.20.11.191	6	64	62	20.20.11.129 – 20.20.11.190
Free Space					64		20.20.11.191 – 20.20.11.255

## Number of Devices and Future Growth

### Large Subnet (Computer Science):

The Computer Science department likely hosts the most devices student and faculty computers, servers, lab equipment, and possibly research clusters. A larger subnet ensures enough IP addresses for all current devices and allows for future expansion without the need to readdress the network.

### Medium Subnet (Engineering Departments, Library):

Departments like Electrical, Mechanical, Civil Engineering, and the library have a moderate number of devices enough to require more than a small subnet, but not as many as Computer Science.

### Small Subnet (Admin Office, Hostel, Faculty):

These areas typically have fewer networked devices (e.g., office computers, printers, staff laptops).

**Free space:** The last /26 subnet (20.20.11.192/26) is left unassigned, explicitly available for future expansion or for a new department

**Scalability:** This approach ensures that if any department grows, the reserved subnet can be allocated, or subnets can be reorganized as needed

### **Justification (Why VLSM?)**

**VLSM** allows assigning subnet sizes based on actual need, minimizing wastage and supporting future scalability.

**Fixed-length subnetting** would waste addresses, as all departments would receive the same size block regardless of need.

### **Summary of IPs Used and Remaining**

**Total Usable IPs Allocated:** 254 (CS) + 126 (EE) + 126 (ME) + 126 (Civil) + 62 (Admin) + 126 (Library) + 62 (Faculty) + 62 (Hostel) = 944

**Remaining:**  $2^6 = 64$

14 Ip's can be reserved for network infrastructure, routers, or future expansion

**Total:** 944+64+14 = 1024

### **Challenges and Solutions**

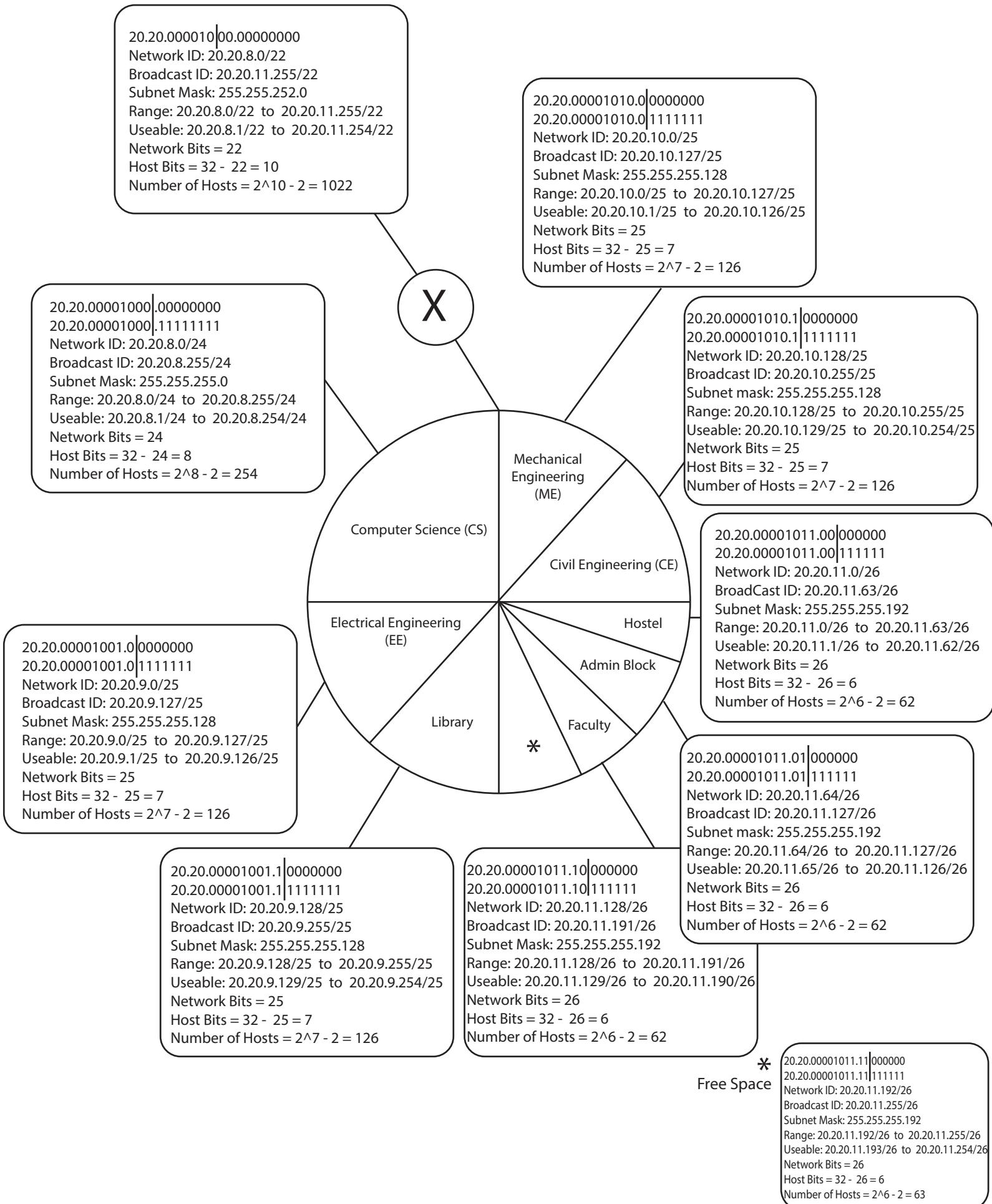
**Challenge:** If a department grows beyond its allocated subnet, reallocation may be necessary.

**Solution:** Plan for periodic review of IP usage and maintain documentation for easy reallocation.

### **Conclusion**

This VLSM-based subnetting plan provides efficient, scalable, and well-documented IP address management for the university, meeting all objectives outlined in the assignment.

# Subnetting Breakdown Diagram



# Packet Tracer Implementation

