Q1. The network of Dimension International School is subnetted based on an IPv4 address of 192.168.3.0/24. The School consists of 20 classrooms and 5 offices. Each classroom and office requires a subnet to support the teaching and administrative works. Answer the following questions.

(i) How many subnets are needed? *(201705 TAR UC, resit)* (1 mark)

* 25

(ii) How many bits must be borrowed to support the required number of subnets? *(201705 TAR UC, resit)* (2 marks)

* 2^5 = 32

|  | N | N | N | H |
| --- | --- | --- | --- | --- |
| Default Subnet Mask | 11111111 | 11111111 | 11111111 | 00000000 |
| Custom Subnet Mask | 11111111 | 11111111 | 111111111 | 11111000 |

* Number of bits borrowed - 5 bits

(iii) How many usable host addresses per subnet? *(201705 TAR UC, resit)* (2 marks)

* (2^3) - 2 = 6

(iv) Compute the decimal value of the new subnet mask. *(201705 TAR UC, resit)* (2 marks)

* Binary value: 11111111 1111111 11111111 11111000
* Decimal Value: 255.255.255.248 (**Dotted decimal notation**)

(v) Compute and list the first 4 subnets information in the table below. Write your answer in dotted decimal format. *(201705 TAR UC, resit)* (8 marks)

| Custom Subnet Mask: 11111111 11111111 11111111 11111000 |
| --- |

| **Subnet**  **No** | **Subnet**  **Address/Prefix Length** | **First Usable**  **Address** | **Last Usable**  **Address** | **Broadcast**  **Address** |
| --- | --- | --- | --- | --- |
| 1 | 192.168.3.0/29 | 192.168.3.1/29 | 192.168.3.6/29 | 192.168.3.7/29 |
| 2 | 192.168.3.8/29 | 192.168.3.9/29 | 192.168.3.14/29 | 192.168.3.15/29 |
| 3 | 192.168.3.16/29 | 192.168.3.17/29 | 192.168.3.22/29 | 192.168.3.23/29 |
| 4 | 192.168.3.24/29 | 192.168.3.25/29 | 192.168.3.30/29 | 192.168.3.31/29 |

Table 1: Subnet Table

Q2. Given Host IP address 192.168.4.210 and subnet mask 255.255.255.240. Complete the Table 2. *(201703 TAR UC, resit)* (8 marks)

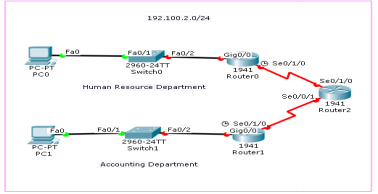
|  | N | N | N | H |
| --- | --- | --- | --- | --- |
| Custom Subnet Mask | 11111111 | 11111111 | 111111111 | 11110000 |

| IP Address | 11000000 | 10101000 | 00000100 | 11010010 |
| --- | --- | --- | --- | --- |
| Custom Subnet Mask | 11111111 | 11111111 | 11111111 | 11110000 |
| Subnet Address | 11000000 | 10101000 | 00000100 | 11010000 |

| Host IP Address | 192.168.4.210 |
| --- | --- |
| Subnet Mask | 255.255.255.240 |
| Number of Subnet Bits | 4 |
| Number of Subnets | 2^4 = 16 |
| Number of Host Bits per Subnet | 4 |
| Number of Usable Hosts per Subnet | (2^4) - 2 =14 |
| Subnet Address for this IP Address | 192.168.4.208 |
| IP Address of First Usable Host on this Subnet | 192.168.4.209 |
| IP Address of Last Usable Host on this Subnet | 192.168.4.222 |
| Broadcast Address for this Subnet | 192.168.4.223 |

Table 2: Custom Subnet Table

Q3. With reference to Figure 1, answer the following questions:

Figure 1: Branch Campus Network

(i) In Figure 1, how many subnets are needed? *(201609 TAR UC, Main)* (1 mark)

* 4 subnets

(ii) How many bits must be borrowed to support the required number of subnets? *(201609 TAR UC, Main)* (2 marks)

* 2 ^ 2 = 4
* 2 bits

(iii) How many usable host addresses per subnet? *(201609 TAR UC, Main)* (2 marks)

* (2^6) -2 = 62 usable host addresses

(iv) Compute the decimal value of the new subnet mask. *(201609 TAR UC, Main)* (2 marks)

|  | N | N | N | H |
| --- | --- | --- | --- | --- |
| Subnet Mask | 11111111 | 11111111 | 11111111 | 00000000 |
| Custom Subnet Mask | 11111111 | 11111111 | 111111111 | 11000000 |
|  | 255. | 255. | 255. | 192 |

(v) Computer and list all possible subnet information in the format given in Table 3. *(201609 TAR UC, Main)* (8 marks)

| **Subnet No** | **Subnet Address/ Prefix length** | **Host Range** | **Broadcast Address** |
| --- | --- | --- | --- |
| 0 | 192.100.2.0/26 | 192.100.2.1/26 - 192.100.2.62/26 | 192.100.2.63/26 |
| 1 | 192.100.2.64/26 | 192.100.2.65/26 - 192.100.2.126/26 | 192.100.2.127/26 |
| 2 | 192.100.2.128/26 | 192.100.2.129/26 - 192.100.2.190/26 | 192.100.2.191/26 |
| 3 | 192.100.2.192/26 | 192.100.2.193/26 - 192.100.2.254/26 | 192.100.2.255/26 |

Table 3: Subnetting Table

Q4. Provide any TWO (2) reasons for subnetting a network. (*201709 TAR UC main*) (4 marks)

* It reduces overall network traffic
* It improves network performance and speed
* Enables administrator to implement security policies such as which subnets are allowed or not allowed to communicate together

Q5. OCM College has an IPv4 network based on 172.38.0.0/16 addresses. They are required to provide subnets with 4,096 hosts per subnet. Based on these needs, answer the following questions.

2^12 = 4096

|  | N | N | H | H |
| --- | --- | --- | --- | --- |
| Subnet Mask | 11111111 | 11111111 | 00000000 | 00000000 |
| Custom Subnet Mask | 11111111 | 11111111 | 11110000 | 00000000 |

(i) How many subnets are needed? (1 mark)

* 16 subnets

(ii) How many bits need to be borrowed to support the required subnets? (2 marks)

* 4 bits

(iii) How many *usable* host addresses per subnet? (2 marks)

* 4096 - 2 = 4094

(iv) What is the decimal value of the new subnet mask? (2 marks)

|  | N | N | H | H |
| --- | --- | --- | --- | --- |
| Subnet Mask | 11111111 | 11111111 | 00000000 | 00000000 |
| Custom Subnet Mask | 11111111 | 11111111 | 11110000 | 00000000 |
| Custom Subnet Mask (D) | 255. | 255. | 240. | 0 |

(v) Calculate and list the subnets information in the table below. Write your answer in dotted decimal format.

| **Subnet No.** | **Network**  **Address** | **First Usable Address** | **Last Usable**  **Address** | **Broadcast**  **Address** |
| --- | --- | --- | --- | --- |
| 1 | 172.38.0.0 | 172.38.0.1 | 172.38.15.254 | 172.38.15.255 |
| 2 | 172.38.16.0 | 172.38.16.1 | 4172.38.31.254 | 4172.38.31.255 |
| 3 | 172.38.32.0 | 172.38.32.1 | 172.38.47.254 | 172.38.47.255 |
| 4 | 172.38.48.0 | 172.38.48.1 | 172.38.63.254 | 172.38.63.255 |

Table 4: Subnet Table (8 marks)