Question 1

a)

i) /21 – 255.255.248.0 – 11111111111111111111100000000000

ii) /13 – 255.248.0.0 – 11111111111110000000000000000000

iii) /29 – 255.255.255.248 – 11111111111111111111111111111000

b)

i) /19 – Max No Host: $2^{13} = 8,192 - 2 = 8,190$

ii) /30 – Max No Host: $2^2 = 4$

iii) /23 – Max No Host: $2^9 = 512$

c)

i)	255.255.224.0 – Yes, /19
ii)	255.128.0.0 – Yes, /9
iii)	255.252.255.0 – Not legal since class b needs to be at 255 in order for class C to be 255.
iv)	255.255.255.254 – Yes, /31

Question 2

a)

<u>**Electronic mail – SMTP (Simple Mail Transfer Protocol)**</u>

<u>**IP Telephony – SIP (Session Initiation Protocol)**</u>

b)

<u>**Electronic Mail**</u>

SMTP (Simple Mail Transfer Protocol), known as a transfer agent, is a transmission protocol for electronic mail by sending mail from a server that's communicated with the user's system. SMTP allows the user to have the ability store mail from an online virtual mail box or in their own system. Examples of SMTP that are used for electronic mail today are Gmail, Outlook and Yahoo Mail.

IMAP (Internet Message Access Protocol) known as a mail access agent, is used to allow the mail server to retrieve email message for email clients by using an **IP** connection. **IMAP** was also created for organisations to easily manage multiple email clients within its email box server. IMAP's server listens on port number 143, but with an SSL (secure socket layer), as its port number is 993.

POP3 (Post office Protocol Version 3) known as a message accessing agent, allows the user to organise and retrieve emails from the virtual mailbox on the receiver's mail server to the receiver's computer. It allows to establish a connection for the user that has to type an access code or username to access their mail box.

<u>**IP Telephony**</u>

SIP (Session Initiation Protocol) is known as a signalling protocol, designed for starting, maintaining and terminating voice sessions using two or more endpoints in real time on IP networks. A logical endpoint network, user agent, allows SIP messages to be sent, received and managed, allowing the client to send requests to another user agent in order to receive the request and sends back with a response. SIP's Registrar is a location service endpoint that accepts register type requests, recordings of the address and parameters from the user agent, allowing to improve scalability of the network.

H.323 known as the international telecommunication union standard, implemented to transmit data audio across IP networks. It's designated to operate signalling and session management functions within a packet telephony network. When establishing an H.323 call, an endpoint sends a setup to the selected endpoint and the selected endpoint responds by connecting both endpoints together to start a call.

MGCP (Media Getaway Control Protocol) is the control over communications protocol through signalling and calling through voice over IP telecommunication systems. It hosts and allows multiple endpoint to engage through the support of multiple connections on the introducing with call features such as call waiting and three-way calling.

c)

<u>Electronic Mail</u>

SMTP - TCP (Port 25)

IMAP – TCP (Port 143)

POP3 – TCP (Port 110)

<u>IP Telephony</u>

SIP – TCP/UDP (Port 5060)

H.323- TCP/UDP (Port 1720)

MGCP – TCP/UDP (Port 2427)

d)

<u>Electronic Mail</u>

<u>SMTP – TCP</u>

TCP was chosen by application designer, SMTP was used in the 1980s and sending messages between each host needs to be reliable in order to keep email transfers efficient. TCP allows verification about the destination address to be ready before sending an email.

<u>IMAP – TCP</u>

The common purpose of using TCP over IMAP to allow the client to maintain a guaranteed connection between mail server without any data lost. A checksum is used to detect any corruption of data being transferred across mail server from the client, making the connection reliable and effective.

<u>POP3 – TCP</u>

POP3 is used for encrypted communication with the client's login details using STLS command which permits TCP to connect to the server using transport layer security (TLS) or secure sockets layer (SSL). TCP provides a secured connection for the client through TCP's checksum and a guaranteed established connection.

<u>IP Telephony</u>

<u>SIP – TCP/UDP</u>

Since SIP is a light-weight protocol, for UDP, when the connection is made, its left effectively on idle until a phone call has been made. However, with TCP, it simply decreases the traffic towards the server by reducing the need to ping the server or re-register the call.

Using both protocols allow SIP to be available for both of them, however using TCP can provide an effective coverage than UDP.

H.323- TCP/UDP

TCP and UDP do their own functions in H.323 to create real-time streaming. H.323 negotiates the TCP port for initialising a call setup, which is used by a call control protocol. Both call protocols then negotiate to the UDP, which allows H.323 use a streaming protocol to create a real time protocol (RTP). Allowing both protocols to come to use in order to enable RTP.

MGCP – TCP/UDP

In MGCP, the plaintext commands usually send to gateways from a call agent through a UDP or TCP, allowing the gateway to translate between audio signals and a packet network. Using both protocols as an option for contact.

e)

Electronic Mail – Client-server

IP Telephony – Peer to peer

f)

Electronic Mail

Email's application architecture of client-server since most protocols such as SMTP, IMAP and POP3 all has a mail server involved when the client is using it. Where the Client is using the server's storage to save and keep emails and it's processing to generate emails in order to send.

IP Telephony

The application architecture of IP Telephony is Peer to peer since it requires two responsive connections from both clients through interconnected nodes to establish a conversation using audio over the internet. With the connection by the internet, two or more clients can engage from their device, using the dependence on the connectivity.