Department of Computer Science
Computer Networks
Due: Monday 23 September (23.59)

Your name:
TA Name:
Time Taken:
Estimated Time: 6 hours

This is an individual assignment

This assignment can be submitted as a pdf using Canvas. For those who like to dabble in the dark arts, the latex version is also available, but you may submit in any legible form you wish. Marks are awarded for question difficulty. While there is typically a relationship between difficulty and length of answer, it may not be a strong one.

Explain your answer or give full derivation of results where appropriate. Solitary solutions without explanation risk receiving 0 points, even when correct. In particular if there are 2 points for a short question, 1 of them will be for the explanation.

Optional: Please include a rough estimate of how long it took you do the assignment so that we can calibrate the work being assigned for the course. (The estimated time is provided purely as a guideline.)

Question:	1	2	3	4	Total
Points:	12	8	10	10	40
Score:					

IPv4 Subnetting

1 . . . . *12 points*

(a) (1 point) What is the Class A, IP Range 127 used for?

```
127 is used to establish a connection locally
(to the same computer being run by the user).
commonly referred to as localhost.
```

(b) (1 point) What is the Class A, IP Range 224-239 used for?

```
The IP range 224 - 239 are used as multicast addresses.
Hosts in this range are able to process datagrams to be
multicast to a network service.
```

(c) (2 points) What does a broadcast address instruct the transmitting host to do with the message?

```
Send it to all the clients in the network. Broadcasting uses
the one-to-all method.
```

(d) (2 points) What address would you use if you wanted to broadcast to just the local network?

```
Using the address 255.255.255.255 would broadcast to
all the clients in the local network.
```

(e) (2 points) What is multicast?

```
Multicast is communication between a single sender and multiple
receivers on a network.
```

(f) (4 points) How is it different from broadcast? (Please include a diagram)

```
Broadcast transports data from a single point to all reachable
destinations on the network.

Multicast transports data from a single point only to
designated destinations within the network).
```

Broadcast
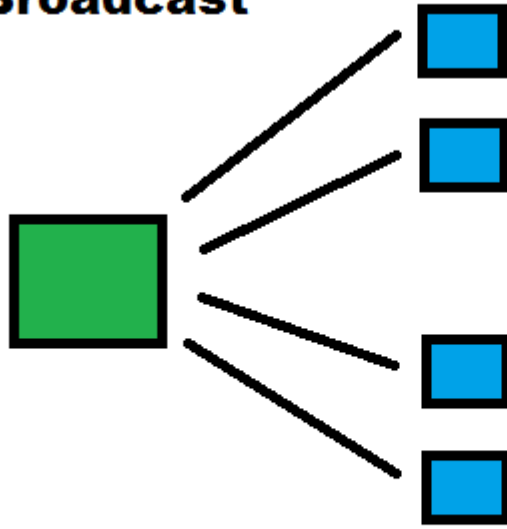
Multicast
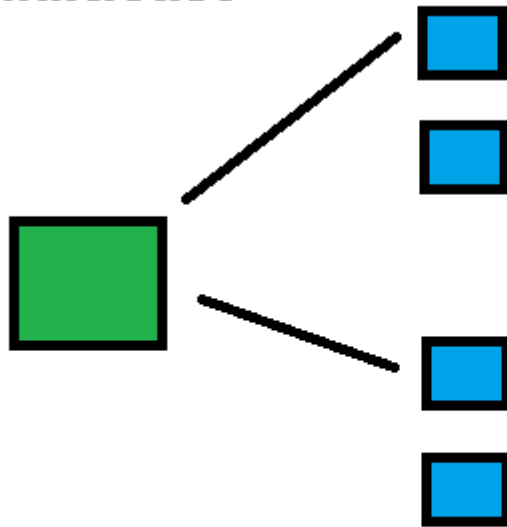
2 . . . . *8 points*

Being able to look at a subnet specification, and list the range of the host IPs is a useful, but rather non-obvious skill to master in networking. It is also quite often used to screen job applicants. The purpose of this question is to help you learn it. The following material may be useful:

`https://learningnetwork.cisco.com/docs/DOC-10924`

(a) (2 points) What is the network mask for a Class D address?

```
A class D bitwise has no host address so there is no need for
a network mask, meaning that the network mask is "undefined".
```

(b) (2 points) What is the network mask for a Class B address?

```
255.255.0.0
```

(c) (2 points) Using Classless Interdomain Routing(CIDR) notation, how many bits are set in the subnet mask of address 10.5.23.132/12

```
The address is a class A address which gives us a subnet mask of 255.0.0.0

11111111.00000000.00000000.00000000/12 =
11111111.11110000.00000000.00000000

4 bits were added to the default mask so the subnet mask has /4 bits
```

(d) (2 points) How many hosts does this subnet mask provide?

```
There are 20 0-bits remaining which gives us 2^20 - 2 hosts.
We subtract 1 for the network number and 1 for the broadcast
number.
```

3.. *10 points*

   (a) (5 points) In the diagram below, subnet the Class C network of 10.5.12.0/24 into 5 subnetworks: List the CIDR and IP ranges of each subnet, and show how many hosts are assigned to each subnet.

Network A: 3 hosts   Network D: 7 hosts

Network C: 2 hosts

Router   Router
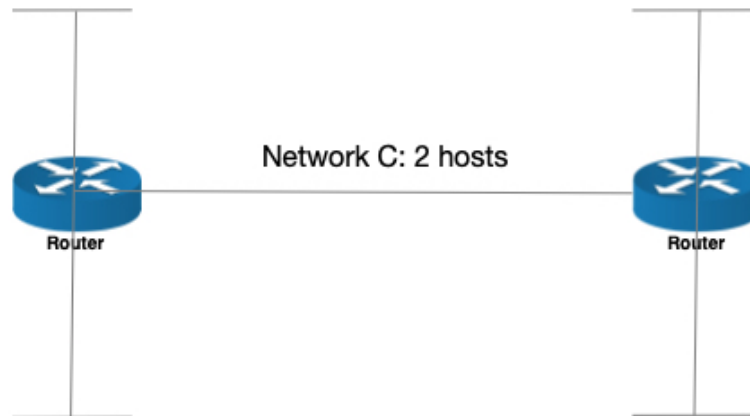
Network B: 26 hosts   Network E: 28 hosts

IP Range	CIDR	Host nr.
10.5.12.0 - 10.5.12.31	/26	62
10.5.12.32 - 10.5.12.63	/26	62
10.5.12.64 - 10.5.12.95	/26	62
10.5.12.96 - 10.5.12.127	/26	62
10.5.12.128 - 10.5.12.159	/26	62

(b) (5 points) Variable length subnet masks(VLSM) is a feature on some equipment that allows different length masks to be used for each subnet, and consequently makes allocating address space more efficient.
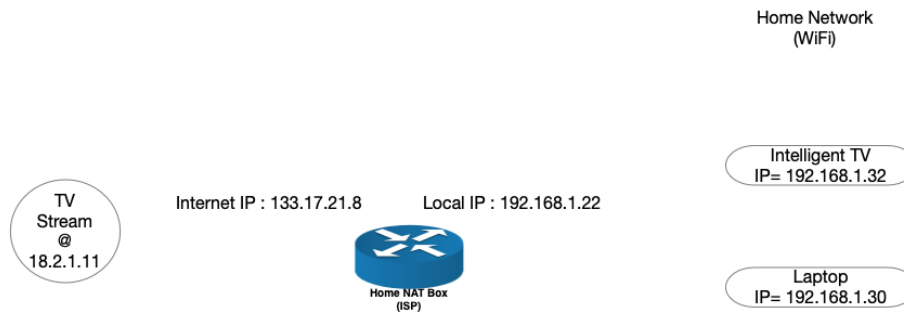
`https://www.tutorialspoint.com/ipv4/ipv4_vlsm.htm`

Taking the same network as above, develop a subnetting scheme using VLSM with the following requirements:

netA	Support 16 hosts
netB	Support 2 hosts
netC	support 5 hosts
netD	support 28 hosts
netE	support 15 hosts

Once again, list the CIDR and IP ranges for each subnet, and show how many host IP addresses are available in each subnet.

Network Address Translation

4 . . . . *10 points*

Home Network
(WiFi)

Intelligent TV
IP= 192.168.1.32

TV
Stream
@
18.2.1.11

Internet IP : 133.17.21.8   Local IP : 192.168.1.22

Home NAT Box
(ISP)

Laptop
IP= 192.168.1.30

The diagram shows a typical home network setup. The WiFi router has an Internet IP address of 133.17.21.8, and an internal IP address (behind the NAT) of 192.168.1.22

There is an Intelligent TV (Local IP 192.168.1.32) and a Laptop (192.168.1.30) also on the home network.

(a) (4 points) Consider that the TV is streaming on its port 8080 from port 54121 on the host for the Internet TV stream at 18.2.1.11

Explain for each step of the **round trip** between the orginating host, and the destination, what address and port are being used. (Hint: fill in a NAT translation table.)

Local IP	Source Port	Internet IP	Source Port
192.168.1.32	8080	18.2.1.11	54121
18.2.1.11	54121	192.168.1.32	8080

(b) (3 points) If the Home NAT Box receives a packet from the Internet, addressed to 192.168.1.30, port 8080, what will it do with it?

Since it's the IP address of the laptop, the NAT box send the packet to the laptop
attempts to connect to its 8080 port.

(c) (3 points) What is the maximum number of connections a NAT box can

The number of connections a NAT box can support is limited
by the port range, which is 16 bits (65,436). Therefore,
the maximum number of connections the box supports is 16 bits.