Solutions to Assignment 4

Question 1

The range of unsigned 16-bit numbers is 1 to $2^{16} - 1$=65535. These are thus the smallest and largest possible link costs. These costs represent data rates, R=$10^8/1$=100 Mb/s and R=$10^8/65535 \approx$ 1.5 kb/s.

Question 2

Sample results from nslookup and whois:

```
Name:  wikipedia.org
Address: 208.80.154.224

NetRange:       208.80.152.0 - 208.80.155.255
CIDR:           208.80.152.0/22
OriginAS:       AS14907

Name:  netflix.com
Address: 69.53.236.17

NetRange:       69.53.224.0 - 69.53.255.255
CIDR:           69.53.224.0/19
OriginAS:       AS55095, AS2906

Name:  sfu.ca
Address: 142.58.102.68

NetRange:       142.58.0.0 - 142.58.255.255
CIDR:           142.58.0.0/16
```

ARIN's database does not give SFU's ASN when you look up the network that includes the host `sfu.ca`. However, by looking up the associated "Organization" (SFU-1) you can find the associated ASN (11105).

Question 3

RIPv2, OSPF, and EIGRP are Interior Gateway Protocols while BGP is an Exterior Gateway Protocol.

A router that connected BCIT's internal network to the internet would have to use both internal and external routing protocols.

Question 4

The options field of a DHCP message is encoded in TLV format with one byte each for Type and Length. There are thus four options:

Type	Length	Value
26	2	6 4
215	1	32
12	2	72 105
255		

The name of each option as given in RFC 2132 and the interpretation of the value field given in the table below:

Type	Option	Value
12	Host Name	text ASCII values 72 and 105 (decimal) are 'Hi'
26	Interface MTU	16-bit unsigned number $= 6 * 256 + 4 = 1540$
215	site-specific	value is 32 but the interpretation undefined
255	end	

Question 5

The BIND-format resource records (RRs) are given in Figure 1.

Question 6

The nslookup commands required to find the IP address of the host `www.ece.ubc.ca` starting at the root of the DNS hierarchy (".") are as follows:

```
nslookup -type=ns .
  returns a.root-servers.net. (and others)
nslookup -type=ns ca. a.root-servers.net.
  returns any.ca-servers.ca. (and others)
nslookup -type=ns ubc.ca. any.ca-servers.ca.
  returns dns3.ubc.ca. (and others)
nslookup -type=ns ece.ubc.ca. dns3.ubc.ca.
  returns dns1.ece.ubc.ca (and others)
```

```
server.notbcit.ca.          A       142.232.1.22          ; server address
@                           NS      server.notbcit.ca.    ; name server for domain
notbcit.ca.                 CNAME   server.notbcit.ca.     ; canonical names
www.notbcit.ca.             CNAME   server.notbcit.ca.
@                           MX      10 smtp.google.com.   ; mail server
```

Figure 1: BIND-format RRs for Question 5.

```
nslookup -type=ns www.ece.ubc.ca. dns1.ece.ubc.ca.

  returns "No answer"

nslookup -type=a www.ece.ubc.ca. dns1.ece.ubc.ca.

  returns the desired result:

Name:  www.ece.ubc.ca
Address: 137.82.61.1
```

Assuming the root name servers were pre-configured and the queries stopped at the DNS server for the domain ece.ubc.ca three servers would have to be queried: one for `.ca` one for `.ubc.ca` and one for `ece.ubc.ca`.

Question 7

For the example given in the question, for a student number of 123456 the IP address would be $23456^2 = 550183936$ and the IP address would be 55.1.83.93.

The nslookup command required would be:

```
nslookup -type=ptr 93.83.1.55.in-addr.arpa.
```

which does not correspond to a valid domain. The square of the previous value would be $550183936^2 = 3027023634...$ corresponding to an IP address of 30.27.2.36. The nslookup command for this address would be:

```
nslookup -type=ptr 36.2.27.30.in-addr.arpa.
```

which also does not have a reverse DNS entry. The next IP address, 91.62.87.20 does have a reverse DNS entry:

```
nslookup -type=ptr 20.87.62.91.in-addr.arpa.
```

which returns:

```
20.87.62.91.in-addr.arpa
name = p5B3E5714.dip0.t-ipconnect.de.
```

Looking up this host name gives the expected result (the IP address):

```
nslookup p5B3E5714.dip0.t-ipconnect.de.
...
Name:  p5B3E5714.dip0.t-ipconnect.de
Address: 91.62.87.20
```