



DUBLIN INSTITUTE OF TECHNOLOGY
KEVIN STREET, DUBLIN 8.

BSc. (Hons.) Degree in Computer Science

YEAR 3

SEMESTER 1 EXAMINATIONS 2015/16

CLIENT SERVER PROGRAMMING (CMPU3006)

Mr. D. Bourke

Tuesday 12th January 9:30 a.m.-11:30 a.m.

Two Hours

Attempt Section A

and any four questions from Section B.

Section A carries 40 marks and

Section B carries 60 marks.

Section A

1. In relation to the following Daytime server code (see Figure 1):

- (i) Identify the three code modifications (note: for this question variable declarations do not count as a modification) necessary to facilitate retrieval of the IP address and port number associated with the connected client application. In your answer: identify the code modification and the line number where the modification should be made. (12 marks)
- (ii) Identify the **type** of the new variable that would be required to hold the addressing data. (3 marks)
- (iii) Identify the function (ignore arguments) that would be required to ensure that the client addressing information is in the correct *byte order* prior to it being used in the server application e.g. for printing to the local screen, for storing in a log file etc. (5 marks)

```

1      .
2      .
3      .
4      int main(int argc, char **argv)
5      {
6          int                listenfd, connfd;
7          socklen_t          len;
8          struct sockaddr_in  servaddr;
9          char                buff[MAXLINE];
10
11         listenfd = Socket(AF_INET, SOCK_STREAM, 0);
12         .
13         .
14         .
15         Bind(listenfd, (SA *) &servaddr, sizeof(servaddr));
16
17         Listen(listenfd, LISTENQ);
18
19         for ( ; ; ) {
20
21             connfd = Accept(listenfd, (SA *) NULL, NULL);
22             .
23             .
24             .
25             snprintf(buff, sizeof(buff), "%.24s\r\n", ctime(&ticks));
26             Write(connfd, buff, strlen(buff));
27
28         }
29
30     }
31

```

Figure 1 – Daytime Server code.

2. Write pseudocode for a **HTTP/1.0** (note the version) *server* application (with file handling functionality):

Your code should commence at the point where the server socket is created i.e. ignore variable declarations and initialisations. In your code identify the following:

- The correct sequence of *socket* primitives used throughout. Precise arguments are not required to be identified,
- The steps necessary for handling the incoming client HTTP request. Focus only on the high-level steps; detailed steps such as “read one character-at-a-time from the file” can be replaced with “read data from the file” etc.

(20 marks)

Section B

3. “Socket” is the first primitive called in any application; client or server. Discuss the following:
- (i) What is the purpose of “the socket” at the point where it is called in either the client or server application i.e. before any other primitives are called? (5 marks)
 - (ii) After creating “the socket” in the server application it is then modified to become a “listening” socket using additional socket primitives. What modifications are required to be made to the original socket to make it a “listening” socket and what primitives are used to make these modifications? (5 marks)
 - (iii) At some point a “connected” socket is created in the server. How does this socket differ to the “listening” socket in terms of what it is used for? (5 marks)
4. In relation to Protocols:
- (i) Explain (at a high level) the basic concept of a protocol. (3 marks)
 - (ii) Using a *box diagram* describe the *syntax* (the structure) of the requests and responses associated with the HTTP protocol. (8 marks)
 - (iii) Describe the *semantics* (the order of communication i.e. which side talks first etc.) of the HTTP protocol. (4 marks)
5. Consider a host machine running an implementation of the TCP/IP protocol stack.
- (i) Identify how the PDUs from each of the layers would appear (in the correct order) in an outgoing stream of bits leaving this host and entering the local network. In your answer represent the PDUs in their simplest form i.e. as a Header field and a Data field. (5 marks)
 - (ii) If this stream of bits arrives at a router identify: which PDUs would be examined by the Router, which PDUs would pass through the Router unchanged and which PDUs would be changed. (5 marks)
 - (iii) Upon arrival at the destination host explain what happens to the PDUs as they pass through the protocol stack. (5 marks)

6. Identify and explain the correct sequence of socket primitives used in a server application up to and including the point where it is ready to accept connection requests from clients. In your answer explain the purpose of each call, identify the return value (if any) from each call (ignore negative values) and identify any buffers created (if any) in the TCP layer as a result of the primitive call. (3 x 5 marks)
7. In relation to TCP connection establishment:
- (i) What primitive is called in the client application to facilitate this process and what is the corresponding primitive called in the server application? In your answer identify which of these primitives must be called first. (5 marks)
 - (ii) How does the local TCP entity (on both the client and server hosts) respond to these primitive calls i.e. what action is undertaken by the TCP entity? In your answer identify all messages exchanged between the two TCP entities for the purpose of establishing the connection. (5 marks)
 - (iii) Provide a high-level illustration of the “connection” between the two applications identifying the individual segments that make-up the connection. In your answer identify the four addressing components that make-up the unique identifier (the socket pair) used by the TCP layer to refer to this connection. (5 marks)