

R249/102

DUBLIN INSTITUTE OF TECHNOLOGY  
KEVIN STREET, DUBLIN 8.

---

# **BSc Information Systems / Information Technology**

**Stage 1**

---

**SUPPLEMENTAL EXAMINATIONS 2008**

---

**PROGRAMMING AND ALGORITHMS**

MR. C. O'LEARY  
PROF. B. O'SHEA

2 HOURS

ATTEMPT **3** QUESTIONS

ALL QUESTIONS CARRY EQUAL MARKS

1. (a) Design using pseudocode and implement in the C programming language a program which prints the initials of a person whose name is stored in a string array. You can assume that the first name starts in position 0 of the array and that a single space separates parts of the name. Where a name includes an apostrophe the letter following the apostrophe is also included as an initial.

Your program must produce output in the form shown below (user input is shown in bold):

```
C:\problems>Q1A
Enter name: Ciaran O'Leary
COL
C:\problems>Q1A
Enter name: John Fitzgerald Kennedy
JFK
C:\problems>Q1A
Enter name: Bertie Ahern
BA
```

(15 marks)

- (b) Using sample code where necessary, briefly answer each of the following short questions.
- i. What is a static variable?
  - ii. What is a global variable?
  - iii. What is the ASCII character set?
  - iv. What is a file pointer?
  - v. What is a binary file?
  - vi. What is a text file?

(6 marks)

- (c) *Sorting algorithms are divided into two classes based on their complexity.*

Identify both classes and describe clearly the characteristics of algorithms in each class.

Use *one* named algorithm to sort the following list of numbers:

6 4 5 3 1 1 2 8

(12 marks)

2. (a) Design using pseudocode and implement in the C programming language a program which checks if one string *ends with* another string.

Your program must produce output in the form shown below (user input is shown in bold):

```
C:\problems>Q2A
Enter string 1: I am the eggman
Enter string 2: man
Yes, they match
```

```
C:\problems>Q2A
Enter string 1: I am the eggman
Enter string 2: n
Yes, they match
```

```
C:\problems>Q2A
Enter string 1: I am the eggman
Enter string 2: e eggman
Yes, they match
```

```
C:\problems>Q2A
Enter string 1: I am the eggman
Enter string 2: I am
No match
```

**(15 marks)**

- (b) Using sample code where necessary, briefly answer each of the following short questions.

- i. What is a replacement character?
- ii. Why is a typecast usually necessary after a call to `getchar()`?
- iii. How is the `+=` operator used?
- iv. How is the `++` operator used?
- v. What will happen if the `++` operator is used on a `char`?
- vi. What words cannot be used as variable names?

**(6 marks)**

- (c) Compare and contrast *linked lists* with *arrays*. Use examples to clearly demonstrate the strengths and weaknesses of each.

**(12 marks)**

3. (a) Design using pseudocode and implement in the C programming language a program to find the square root of a positive whole number. Where the square root is not a whole number, you must print out the two whole numbers between which the square root is located.

*Note that a square root of a number multiplied by itself gives the number.*

*For example, since  $2 * 2 = 4$ , 2 is the square root of 4.*

*Since  $2.236067977 * 2.236067977 = 5$ , 2.236067977 is the square root of 5.*

Your program must produce output in the form shown below (user input is shown in bold):

```
C:\problems>Q3
Enter number: 4
Square root: 2
```

```
C:\problems>Q3
Enter number: 5
Square root between: 2 and 3
```

```
C:\problems>Q3
Enter number: 55
Square root between: 7 and 8
```

**(15 marks)**

- (b) Using sample code where necessary, briefly answer each of the following short questions.

- i. What is a literal?
- ii. What is a variable?
- iii. In what circumstances is it preferable to use an unsigned variable rather than a signed variable?
- iv. What are the operators `||` and `&&` used for?
- v. What is the `%` operator used for?
- vi. What are the two styles of comment that can be used in C?

**(6 marks)**

- (c) Show how you would implement the two operations of *either* a *stack* or a *queue* as either a *linked list* or an *array*. Use pseudocode, C code and / or diagrams as appropriate.

**(12 marks)**

4. (a) Design using pseudocode and implement in the C programming language a program to find the highest digit in a number. You may assume that the number is positive and not equal to zero.

Your program must produce output in the form shown below (user input is shown in bold):

```
C:\problems>Q4
Enter number: 24601
Highest digit: 6
```

```
C:\problems>Q4
Enter number: 21062007
Highest digit: 7
```

**(15 marks)**

- (b) Using sample code where necessary, briefly answer each of the following short questions.

- i. How is the preprocessor used to declare the size of an array?
- ii. Why is the preprocessor sometimes used to declare the size of an array?
- iii. What is the relationship between arrays and character strings?
- iv. What is the relationship between arrays and pointers?
- v. How can memory be allocated at runtime for an array?
- vi. How can an array length be extended at runtime?

**(6 marks)**

- (c) Explain what is meant by pseudo-random numbers, and describe an algorithm to generate simple pseudo-random numbers using the Fibonacci series.

**(12 marks)**