

DUBLIN INSTITUTE OF TECHNOLOGY

KEVIN STREET, DUBLIN 8.

BSc (Honours) Degree in Computer Science

Year 1

SEMESTER 2

EXAMINATIONS 2012-2013

PROGRAMMING WITH PERSISTENT DATA

Dr. Q. Wang

Dr. D. Lillis

Date: Monday, 13th May 2013

Time: 1:00 – 3:00

Attempt Question 1 and two other questions.

Question 1 carries 40 marks, all other questions carry 30 marks each.

1. Examine the following program code:

```
#include<stdio.h>

-struct database {
    int id_number;
    int age;
    float salary; };

|
main()
- {
    FILE * f;
    struct database employee[10];
    int i;

    f = fopen("database.dat", "rb");

    fread(&employee,sizeof(employee),1,f);

    for (i=0;i<10;i++)
- {
        printf("== Employee Data ==\n");
        printf("ID: %d \n", employee[i].id_number);
        printf("Age: %d \n", employee[i].age);
        printf("Salary: %f \n", employee[i].salary);
    }

    fclose(f);
    return 0;
}
```

- (a) Explain each of the program statements in the boxes (e.g. #include <stdio.h>), including syntax and any parameters/constants required.

(20 marks)

- (b) Describe the overall workings of the program, in terms of the inputs received, any processing on data and outputs expected.

(20 marks)

2. (a) A disk access can be divided into the following three distinct physical operations:
- Seek time
 - Rotational delay
 - Transfer time

Explain the cost associated with each of the operations.

(10 marks)

- (b) Our disk drive has four surfaces (two platters), with one read/write head per surface. There are 612 tracks per surface, 16 sectors per track, and 512 bytes per sector. The drive uses a cluster size of 16 sectors (8K bytes) and an extent size of one cluster, so space is allocated for storing files in one-track units. Sectors are interleaved with an interleaving factor of 5, so a track can be transferred in five revolutions. Since one revolution takes 16.7 msec, one track can be transferred in 83.5 msec.

Let's suppose that, given this disk, we want to know how long it will take to read a 128K byte file that is divided into 256 sector-sized records. We first need to know how the file is distributed on the disk. Since each cluster is one track, our file will be stored as a sequence of tracks. Since each track of the disk holds 8K, the disk needs 16 tracks to hold the entire 128K bytes that we want to read. We assume a situation in which the 16 clusters are randomly dispersed over the surface of the disk.

Calculate the total time required for both the sequential access and random access.

(20 marks)

3. For a fixed length record file a deletion strategy must provide some way to recognise that records are deleted from a file and provide a mechanism for the subsequent re-utilisation of freed space.

(a) Describe how the use of a special mark can identify deleted records.

(15 marks)

(b) Explain how linked lists can improve the process of freed space reutilisation.

(15 marks)

4. For variable length record files, an avail list mechanism can be used to manage available space once records have been deleted. A placement strategy is the process of placing freed record space onto an avail list. Describe the operation and benefits of the following placement strategies:

(a) First fit strategy.

(10 marks)

(b) Best fit strategy

(10 marks)

(c) Worst fit strategy.

(10 marks)