Lebanese University
Faculty of Sciences 1

I2204 E – INFO216 E

Imperative Programming

Final 2016-2017
Fri. Feb. 3rd pm
Duration: 2 hours

Exercise I [30 min, 20 = 4x5 points] Lab Based Question : Geometric Shapes

Consider the Lab Point, Rectangle, with the following data types:

```
typedef struct point{int x,y;} Point;
typedef struct rec{Point vertices[4];} Rec;
```

Note that we consider only the rectangles whose sides are parallel to the orthogonal axis.
Consider the function distance already defined and implemented with the following prototype:

```
double distance(Point p1, Point p2);
```

1. Write the function "isSquare" which indicates if a given rectangle is a square.
2. Write the function "isInside" which indicates if a given point is inside a given rectangle.
3. Define the type Tri to represent a triangle.
4. Write the function "isIsosceles" which indicates if a given triangle is isosceles. An isosceles triangle is a triangle with at least two equal sides.
5. Write the function "isTriInside" which indicates if a given triangle is inside a given rectangle.

Exercise II [25 min, 13 points] No Duplication Allowed

Consider the following data type:

```
typedef struct node{int d; struct node *next, *prev;} node;
```

Write the function "clean" which, given a doubly linked list of integers, not sorted, finds and deletes all the duplicates from the list.
For example, the list [1⇌ 5 ⇌ 9⇌ 5⇌ 1⇌ 3⇌ 3⇌ 1⇌ 1] becomes after the call to clean [1⇌ 5⇌ 9⇌ 3].

Exercise III [25 min, 20 points] Student grades

Consider the following data type:

```
typedef struct node{int id, grade; char name[30];} node;
```

We keep the grades of the students in the course "Imperative programming" in two binary files of nodes : "partial" and "final". Both files are sorted according to the student ids.
Write the function "merge" which creates and fills the text file "result.txt" containing the resulting grade for each student. The file "result.txt" must be also sorted according to the student id. It should contain on each line, the student id, the student name and the total grade, all tab separated. Pay attention that we may have absence in either exams, i.e., a student may be present the partial and not the final and vice versa. You are not allowed to use dynamic allocation nor allocate huge arrays in the stack.

Exercise IV [40 min, 20 points] Mirror Mirror …

Write a recursive function "mirror" that takes a linked list of integers as a parameter and appends to it, a mirrored version of itself. You can only iterate the list once (each node can only be visited once).
For example, the list [10, 50, 19, 54, 30] becomes after the call to mirror [10, 50, 19, 54, 30, 30, 54, 19, 50, 10].