Lebanese University
Faculty of Sciences 1

INFO216 E

Imperative Programming II

Partial 14.15
Tue. April 14th pm
Duration: 1 hour

Exercise I

Draw the memory state of the following program, and deduce what does the function f.

```
void f(int n, int r){
        if (n==0) return r;
        return f(n-1,r*n);
}
void main(){
        int num=3, s;
        s=f(num,num);
}
```

Exercise II

We consider the tic-tac-toe game. It is played on a square grid of size n x n. We recall the rules; Each of the two players chooses one symbol. They place alternately their symbols on the grid until one of them manages to fill a line, or a column or one of the main diagonals with his symbol.

X	X	O	
O	O	O	O
X		X	
X			

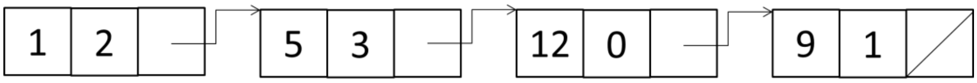
Grid 4x4
Game Over!
Player ('O') wins!
He completed row 2.

Write the function "play" which does the following. Given a grid, a row number, a column number and a symbol, the function places the symbol in the requested cell on the grid, if the cell was empty. The function also checks if the player wins after this action. It returns 0 if the action is not allowed; i.e., if the cell was already filled, 1 if the action was done and there is no winner so far and 2 if the action just finished the game and we have a winner. The function does not print on the screen. You should use the pointer syntaxe to iterate the arrays and not the array syntaxe.

Exercise III

We consider a simply linked list to represent polynomials. An example of a polynomial is as follows: $x^2+5x^3+12+9x$. Each term is definied by a coefficient (coef) and an exponent (exp), both of type int. The polynomial is not ordered according to the exponents of x.

$$\underbrace{\underbrace{x^2}_{\text{term}} + \underbrace{5x^3}_{\text{term}} + \underbrace{12}_{\text{term}} + \underbrace{9x}_{\text{term}}}_{\text{polynomial}}$$



1. Define in C the recursive structure representing a term.
2. Write the function addTerm() which, given a coefficient and a exponent, pushes a new term to the head of a given polynomial, if the exponent is not present yet in the polynomial, or else it updates the value of the old coefficient. Example:

   Initial polynomial: $5x^3+12+9x$
   After a call to addTerm (coef=1, exp=2): $x^2+5x^3+12+9x$
   After another call to addTerm (coef=4, exp=3) : $x^2+9x^3+12+9x$