Assignment week 5

Exercise 1)

(1) (Text answer) (Old exam question) A function `area` calculates and returns the area of a rectangle as an integer. The input rectangle is given as four integer coordinates: `x1`, `x2`, `y1`, `y2`. Complete the function signature below.

```
1
2
3 _________ _________ ( ____________________________________ ) {
4
5   return (x2 - x1) * (y2 - y1);
6 }
```

Seeing as the function is supposed to calculate the area of a square, the function signature must have all coordinates defined to compute. It can be written as such:

Int rect_area(int x1, int x2, int y1, int y2)

Exercise 2)

(2) (Text answer) (Old exam question) The function `increment` takes a pointer to an integer and adds `1` to the integer value to which it pints. The function does not return any value. Complete the function signature and function body below, so that the main function prints `6` when executed.

```
1
2
3 ___________ ____________________ ( _______________ ) {
4
5
6   ____________________;
7 }
8
9 int main () {
10   int v = 5;
11   increment(&v);
12   printf("%d", v);
13   return 0;
14 }
```

The function is called by “incement” and the integer defined to 5 is “v”. Therefore, the function can be written as such:

Int increment(int v) {

v++;

}

Exercise 3)

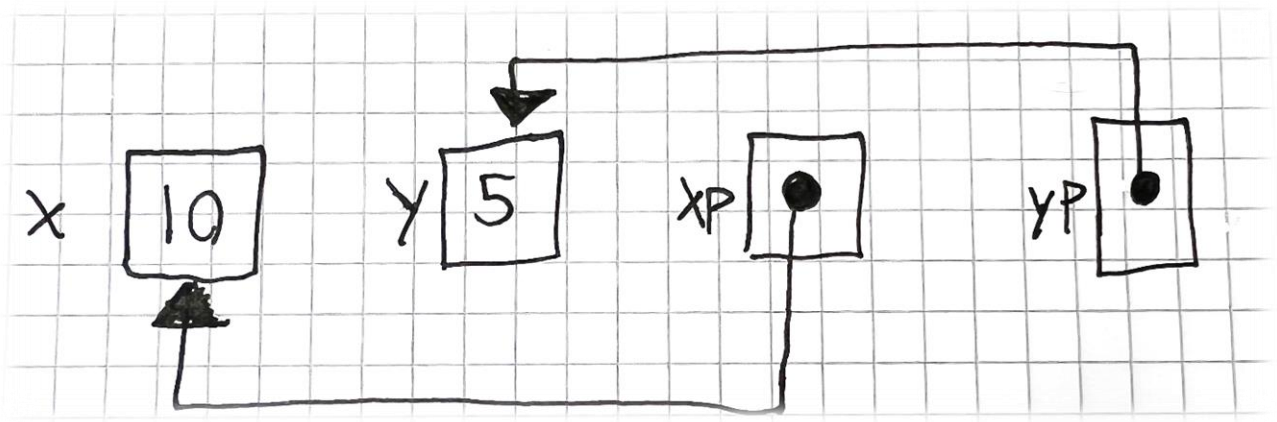
(3) (Text answer) Consider the following code. At the end of the function, what are the values for $x, y, *xp, *yp$? Using pen and paper, draw a diagram (like in the lectures) to explain your answer. Your submission must include your diagram. The following diagram formats are allowed: PDF, JPG and PNG.

```
#include <stdio.h>

int main(void)
{
  int x;
  int y;

  int *xp;
  int *yp;

  x = 5;
  y = x;

  xp = &x;
  yp = &y;

  x = 10;

  /* What are values of: x,y,*xp,*yp */

  printf("x=%d, y=%d, *xp=%d, *yp=%d\n", x,y,*xp,*yp);

  return 0;
}
```

The final values for x, y, *xp, *yp are as follow:

x = 10	y = 5	*xp = 10	*yp = 5

Pointer diagram:



Exercise 4)

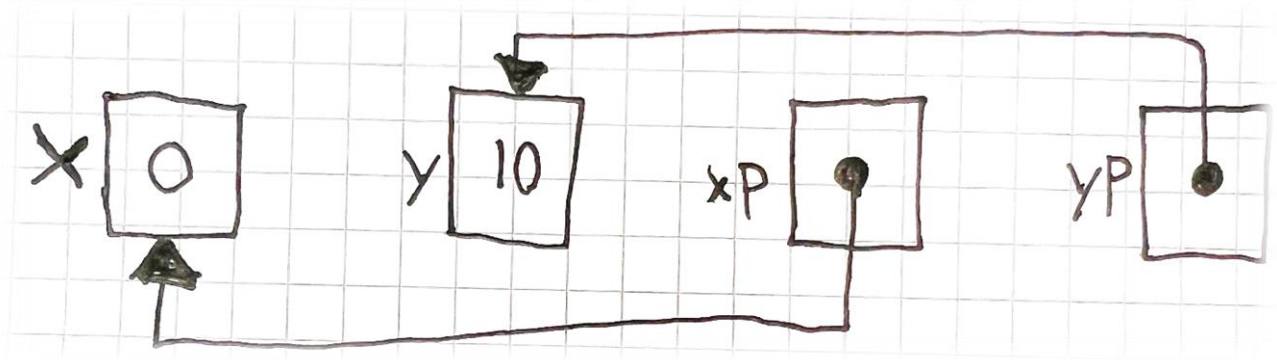
(4) (Text answer) Consider the following code. At the end of the function, what are the values for $x, y, *xp, *yp$? Using pen and paper, draw a diagram (like in the lectures) to explain your answer. Remember to include your diagram (in PDF, JPG or PNG format) in your submission.

```
#include <stdio.h>

int main(void)
{
  int x;
  int y;

  int *xp;
  int *yp;

  x = 5;

  xp = &x;

  x = 10;

  y = *xp;

  yp = &y;

  *xp = 0;

  /* What are values of: x,y,*xp,*yp */

  printf("x=%d, y=%d, *xp=%d, *yp=%d\n", x,y,*xp,*yp);

  return 0;
}
```

The final values for x, y, *xp, *yp are as follow:

x = 0	y = 10	*xp = 0	*yp = 10

Pointer diagram:



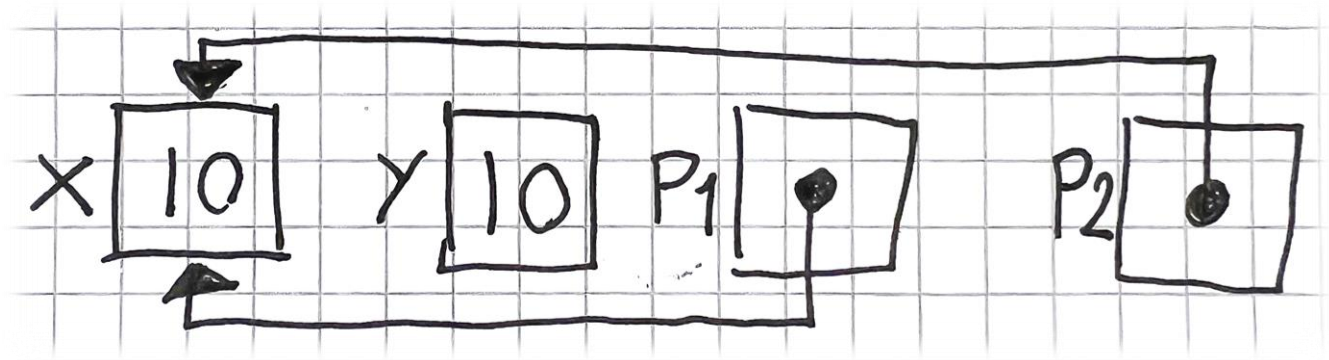
(5) (Text answer) Once again, consider the following code. At the end of the function, what are the values for $x, y, *xp, *yp$? Using pen and paper, draw a diagram (like in the lectures) to explain your answer. Remember to include your diagram (in PDF, JPG or PNG format) in your submission.

```
#include <stdio.h>

int main(void)
{
  int x;
  int y;

  int *p1;
  int *p2;

  x = 5;
  y = 10;

  p1 = &x;
  p2 = p1;

  *p2 = y;

  p1 = &x;

  /* What are values of: x,y,*xp,*yp */
```

The final values for x, y, *xp, *yp are as follow:

x = 10	y = 10	*p1 = 10	*p2 = 10

Pointer diagram:



Exercise 6)

(6) (Code answer) In the lecture we discussed how to represent a geometric *point* using a C struct. Let's now consider a geometric *circle*: a circle consists of three integers: x coordinate of the centre point, y coordinate of the centre point, and a *radius*.

(a) Write a C struct that represents a *circle* using a C struct with an integer representing the radius (named `r`) and a *point* (named `p` and using the struct shown in class).

(b) Create an array of five circles $c[5]$ such that circle c_i has centre point (i, i) and radius i

(c) Create a function *circleIsValid* that takes a pointer to a circle as input, and returns *true* if the radius of the circle is positive ($r > 0$) and *false* otherwise. The function should have the following signature: `int CircleIsValid(const circle *c)`

(d) Create a function *translate* that takes a pointer to a *circle* c and a pointer to a geometric *point* p (like in the lecture), and adds the coordinate values of p to the centre point coordinate values of c, i.e. it translates the circle by a vector represented by the point p. For example, if c is initially centred at $(5, 10)$ and we pass, as input, a point p with coordinate values $(1, -1)$ then the centre point of c becomes $(6, 9)$ after the *translate* function. The function should have the following signature: `void translate(circle *c, const point *p)`

a)

(a) A sequence of $n > 0$ integers is called a *jolly jumper* if the absolute values of the differences between successive elements take on all possible values 1 through $n - 1$. For instance, 1 4 2 3 is a jolly jumper, because the absolute differences are 3, 2, and 1, respectively. As another example, 11 7 4 2 1 6 is a jolly jumper, because the absolute differences are 4, 3, 2, 1, 5 (the order of the differences does not matter). The definition implies that any sequence of a single integer is a jolly jumper. Write a function to determine whether a sequence is a jolly jumper. The function should have the following signature: `int isJollyJumber(const int seq[], int size)` (Hint: use a boolean array, e.g. `bool diffs_found[n]` to keep track of the differences found so far between consecutive numbers. So that `diffs_found[2]` being `true` implies that the absolute difference 2 has already been found.

(b) Write a test program that reads the size and sequence, and uses the function to print out if the sequence is a JollyJumper or not.:

Input A line of input contains an integer $n < 100$ followed by n integers representing the sequence.

Output For the line of input generate a line of output saying "Jolly" or "Not jolly".