CPE102 Programming II

Week 3

Recursive Functions Examples

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Recursion example

- Program that prints the multiplication table as a recursive.

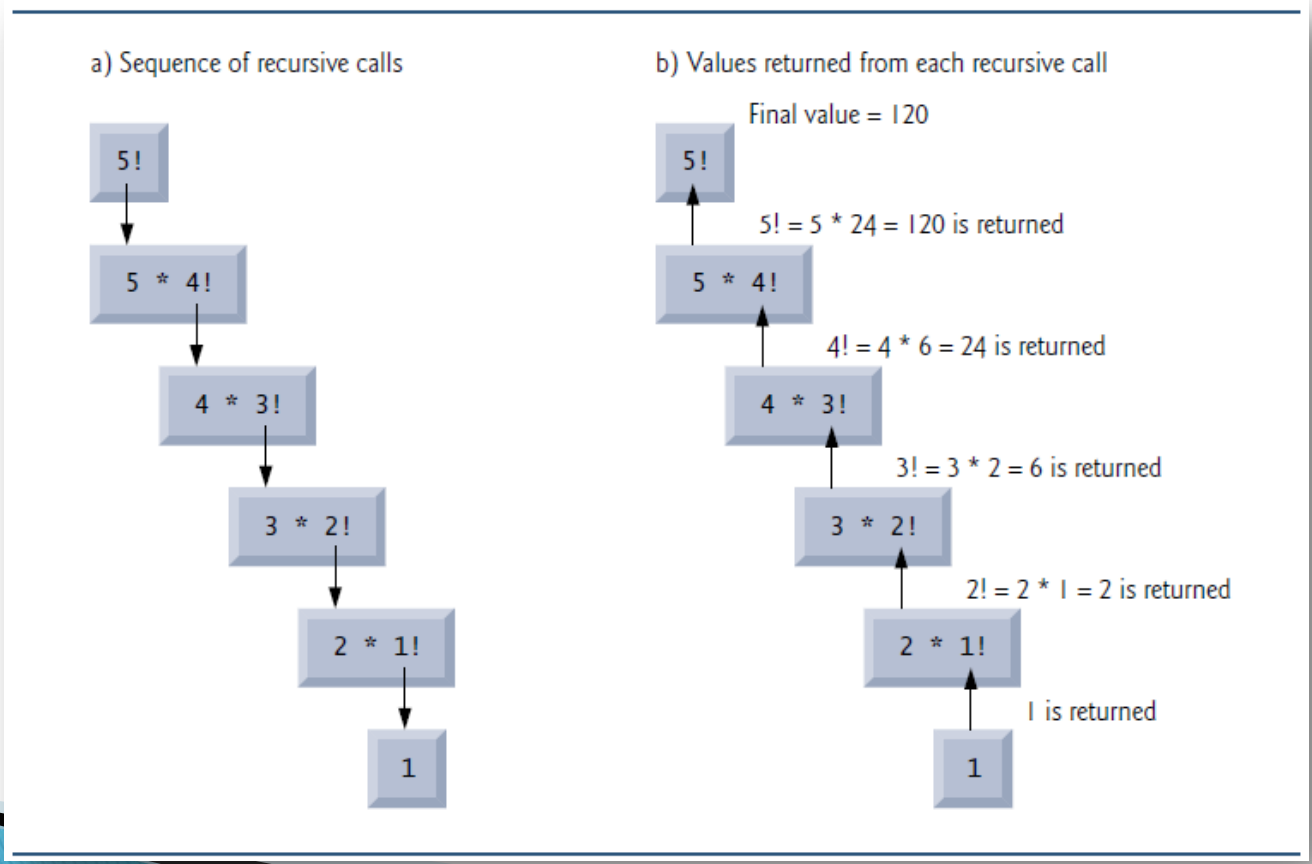
RecursionMultiplicationTable.c

```
1   #include <stdio.h>
2
3   int tablo(int x) {
4     int i;
5     if(x<= 10) {
6       for(i = 1; i<11; i++)
7           printf("%-3d", x*i);
8       printf("\n");
9       return tablo(x+ 1);
10    }
11  else
12    return 1;
13  }
14
15  int main(void){
16    int x = 1;
17    tablo(x);
18    return 0;
19  }
```

Recursion–factorial function

- A recursive definition of the factorial function following this : n! = n. (n–1)!
- Example: 5! = 5. 4. 3. 2. 1
- Notice that
  - 5! = 5. 4!
  - 4! = 4. 3!...
- Then we can compute factorials recursively
  - Solve base case (1! = 0! =1) then
  - 2! = 2. 1! = 2*1 = 2
  - 3! = 3. 2! = 3*2 = 6

Recursion–factorial function



Recursion–factorial function

- Recursion program to calculate and print the factorials of integers 0–10.

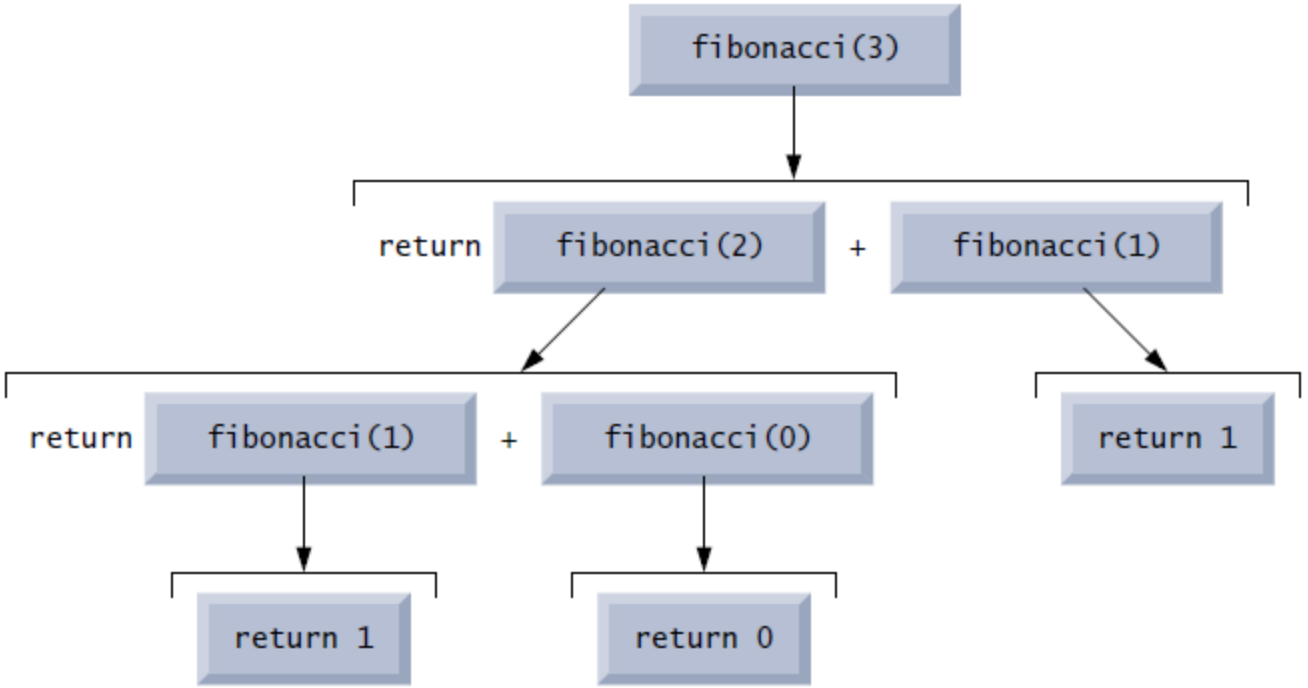
factorial.c

```
1  #include <stdio.h>
2
3  long factorial(long n){
4      if(n<= 1)
5        return 1;
6      else
7       return(n*factorial(n-1));
8  }
9
10 int main(void){
11   int i;
12   for(i = 0; i <= 10; i++) {
13       printf("%d! = %d\n", i, factorial(i));
14    }
15  return 0;
16 }
```

Recursion–Fibonacci Numbers

- Fibonacci series: 0, 1, 1, 2, 3, 5, 8…
- Each number is the sum of the previous two.
- Base case:
  - Fib(0) = 0
  - Fib(1) = 1
- Can be solved recursively:
  - Fib(n) = Fib(n–1) + Fib(n–2)

Recursion–Fibonacci Numbers



Recursion-Fibonacci Numbers

*Fibonacci.c

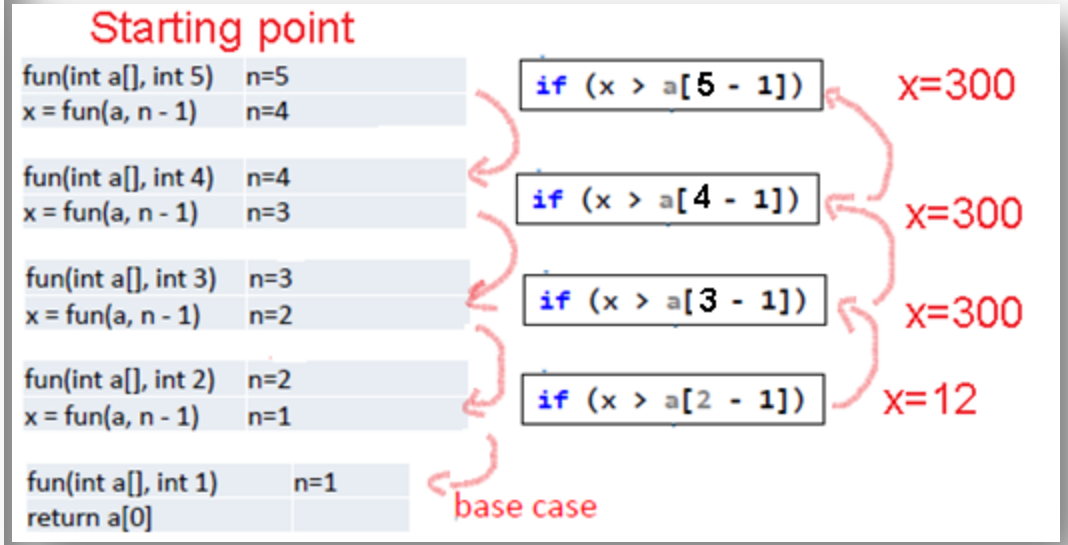
```c
#include <stdio.h>

long fibonacci(long n){
  if(n== 0 || n== 1)
     return n;
  else
   return fibonacci(n-1) + fibonacci(n-2);
}
int main(void){
 long i, n;
   printf("How many fibonacci numbers?:");
   scanf("%d", &n);
   for(i = 1; i <= n; i++){
        printf("fibonacci(%d): %ld\n", i, fibonacci(i));
      }
return 0;
}
```

Recursion example

- Find out the output of the program below. What does fun() do in general?

RecursionArr.c

```
1  #include <stdio.h>
2  int fun(int a[], int n){
3   int x;
4   if(n== 1)
5      return a[0];//base case
6   else
7      x = fun(a, n-1);
8   if(x > a[n-1])
9        return x;
10  else
11     return a[n-1];
12 }
13 int main(){
14  int arr[] = { 12, 10, 300, 50, 100 };
15  int len = sizeof(arr) / sizeof(arr[0]);
16  printf(" %d ", fun(arr, len));
17  getchar();
18  return 0;
19 }
```



Homework-2 (Recursion)

Question1

- Write c program to print the sum of the array elements using recursive function.
- You should have the main function + function to find the summation.

Question2

- Write recursive function that returns the value of the following recursive definition:
  - f(x) = 0 if x<= 0
  - f(x-1)+ 2 otherwise
- You should have the main function + the recursive function.

Notes

- Upload your answer as c file to the first Assignment tag at https://oys.karabuk.edu.tr/
- Don't send homework to my email.
- You have from 17/3/2021 till 23/3/2021, no extension will given.
- Only one c file will be accepted.

Thanks ☺