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Class: BCSE II Sem: First
Session 2020-21

Assignment Set: 1 Problem No. 1

Problem Statement: Write a program to compute the factorial of an integer n iteratively and recursively. Check when there is overflow in the result and change the data types for accommodating higher values of inputs.

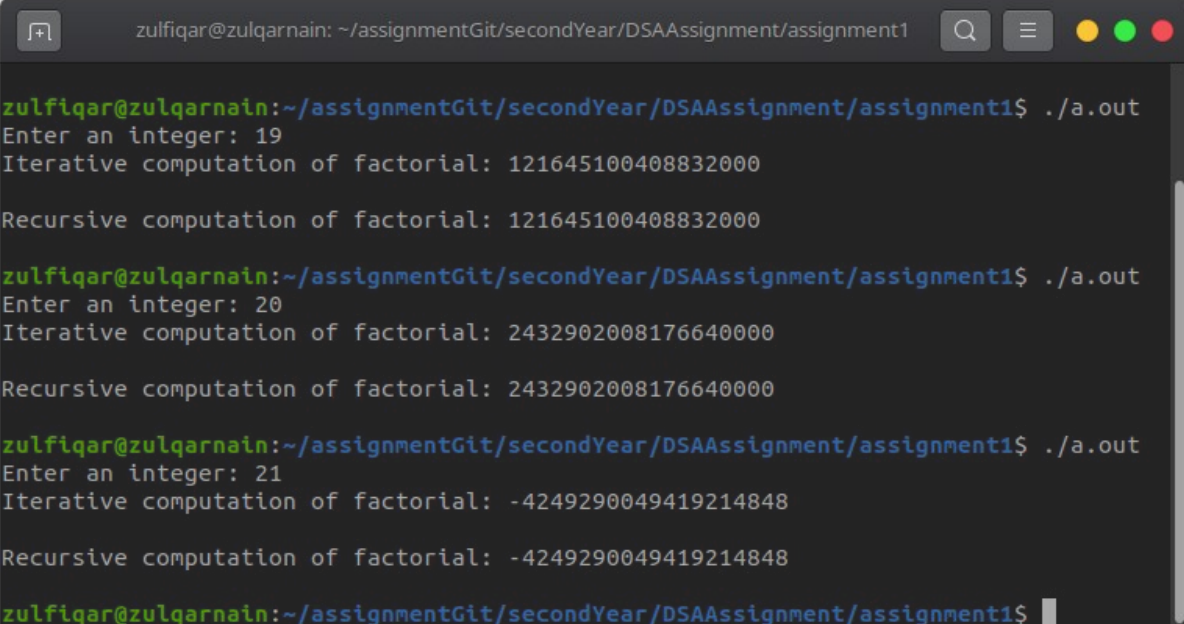
Solution Approach: Take a variable 'product' initialised to 1, then run a loop where it multiplies 'product' with no. Of iteration (1,2,3,...,n), thus we get , product = $1 * 2 * .. * n$

Structured Pseudocode:

```
Read n
prod = 1
for i=1 to n do:
    prod = prod * i
end for
print prod
```

Results:

output1:



```
zulfiqar@zulqarnain: ~/assignmentGit/secondYear/DSAAssignment/assignment1
zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$ ./a.out
Enter an integer: 19
Iterative computation of factorial: 121645100408832000
Recursive computation of factorial: 121645100408832000

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$ ./a.out
Enter an integer: 20
Iterative computation of factorial: 2432902008176640000
Recursive computation of factorial: 2432902008176640000

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$ ./a.out
Enter an integer: 21
Iterative computation of factorial: -4249290049419214848
Recursive computation of factorial: -4249290049419214848

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$
```

output2:

```
zulfiqar@zulqarnain: ~/assignmentGit/secondYear/DSAAssignment/assignment1
Iterative computation on array of digit:-
Number is: 51090942171709440000

Iterative factorial using built in data types: -4249290049419214848

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$ ./a.out
Enter the number: 22
Iterative computation on array of digit:-
Number is: 1124000727777607680000

Iterative factorial using built in data types: -1250660718674968576

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$ ./a.out
Enter the number: 23
Iterative computation on array of digit:-
Number is: 25852016738884976640000

Iterative factorial using built in data types: 8128291617894825984

zulfiqar@zulqarnain:~/assignmentGit/secondYear/DSAAssignment/assignment1$
```

Discussion

- In the results section , we see the output1 of 19!,20!,21! computed using normal *long long* type(64bit), and it clearly overflows for the value 21!
- output2: here, an array of integer is used to represent an integer and corresponding function are defined to multiply such numbers. Thus we see here no overflow occurs and higher values are shown.(But when computed iteratively using built in data type, overflow occurred again)

Separate files containing commented source code: Two source code are attached,:

assignment1-a.c :- It computes factorial using built in data type *long long* (64bit)

assignment1-b.c :- It computes factorial using an array of digit to represent the number.