02. Recursion

msdb@korea.ac.kr

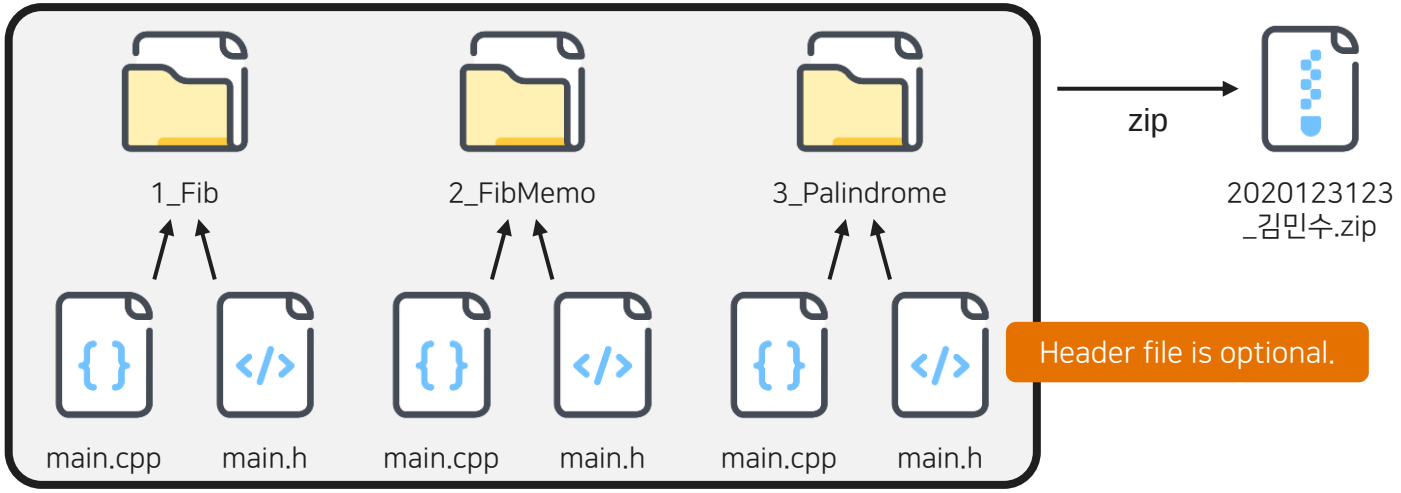
hyubjinlee@korea.ac.kr

Agenda

- Instruction
- Recursion Problems
  - Fibonacci Numbers
  - Memoization Fibonacci
  - Palindrome

Instruction

- All programs are written with C.
- Please submit your works on Blackboard.
- Archive your code and header files into a ZIP file and submit the ZIP file.
  - Do not submit a whole project.
  - Do not include executable files (.exe) or debug folders.
- Make sure that your ZIP file follows a naming convention.
  - (student number)_(name).zip -> E.g. 2020123123_김민수.zip



Folder> 1_Fib

Fibonacci Numbers

- Fibonacci Numbers
  - $fibo_0 = 0,\ fibo_1 = 1$
  - $fibo_{n+2} = fibo_n + fibo_{n+1}$

- Instruction:
  - Follow the given function definitions.
  - Each function takes n value and return n^{th} Fibonacci number.

1. Implement a Fibonacci function with iteration (loop).
   - int fibLoop(int n)
2. Implement a Fibonacci function with recursion.
   - int fibRecursion(int n)

```
Loop::
 0 : 0
 1 : 1
 2 : 1
 3 : 2
 4 : 3
 5 : 5
 6 : 8
 7 : 13
 8 : 21
 9 : 34
--------------------
Recursion::
 0 : 0
 1 : 1
 2 : 1
 3 : 2
 4 : 3
 5 : 5
 6 : 8
 7 : 13
 8 : 21
 9 : 34
```

E.g. 01

Folder> 2_FibMemo

Memoization Fibonacci

- Is your Fibonacci function with recursion works at n=50?
- Make a Fibonacci function works at n>50 using a memoization.
  - Store Fibonacci numbers in an array and utilize them.
  - long long fibMemoization(long long* arr, int n)

```
Memoization::
50: 12586269025
51: 20365011074
52: 32951280099
53: 53316291173
54: 86267571272
55: 139583862445
56: 225851433717
57: 365435296162
58: 591286729879
59: 956722026041
```

E.g. 02

- Note:: You will need a 64-bit integer type.
  - Use “long long” or “int64_t” (include cstdint)

Folder> 3_Palindrome

Palindrome

- Create a function checking an input string is palindrome.
  - Using recursion, create a function to find the length of an input character string.
    - int getStrLength(const char* str, int length)
    - Return the length of a string
  - Create a palindrome function to determine whether the string is palindrome.
    - bool palindrome(const char* str, int start, int end)
    - Return true if a string is palindrome

```
a: The string is palindrome
noon: The string is palindrome
kayak: The string is palindrome
palindrome: The string is not palindrome
```

E.g. 03