Amirkabir University of Technology
(Tehran Polytechnic)

Operating Systems

Processes-Part3

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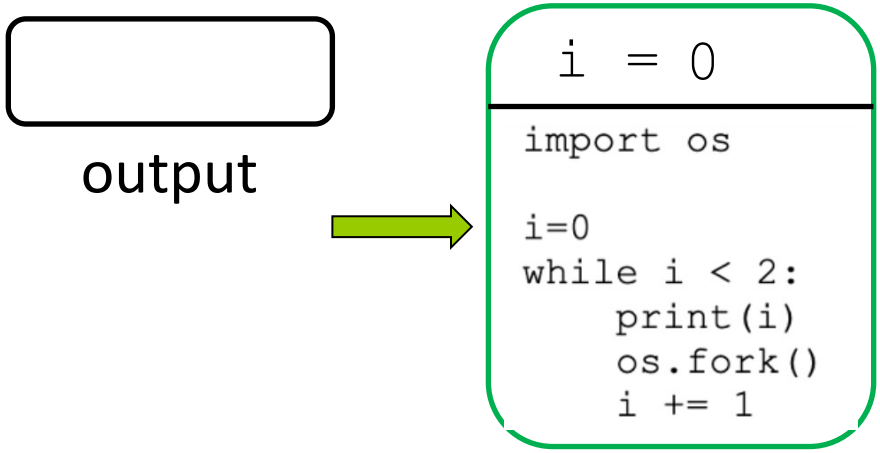
Fork Example



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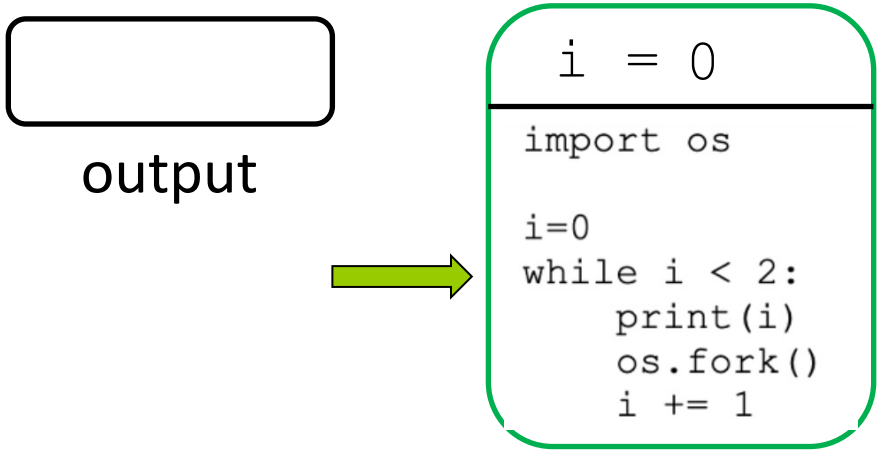

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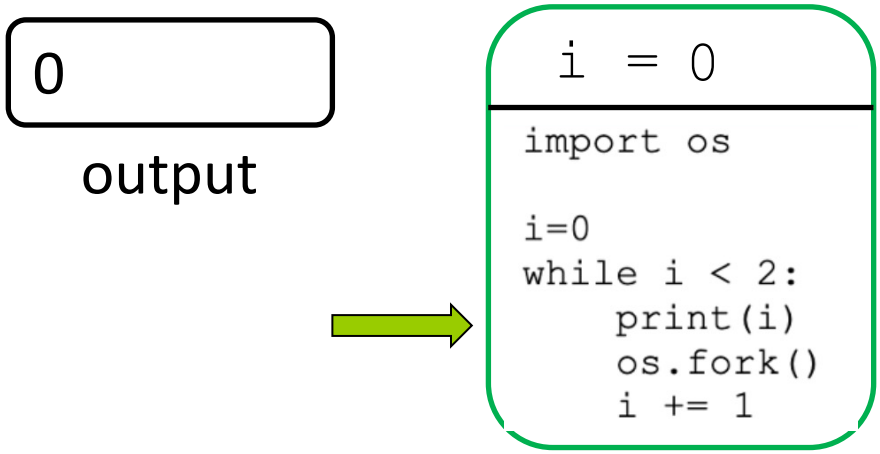

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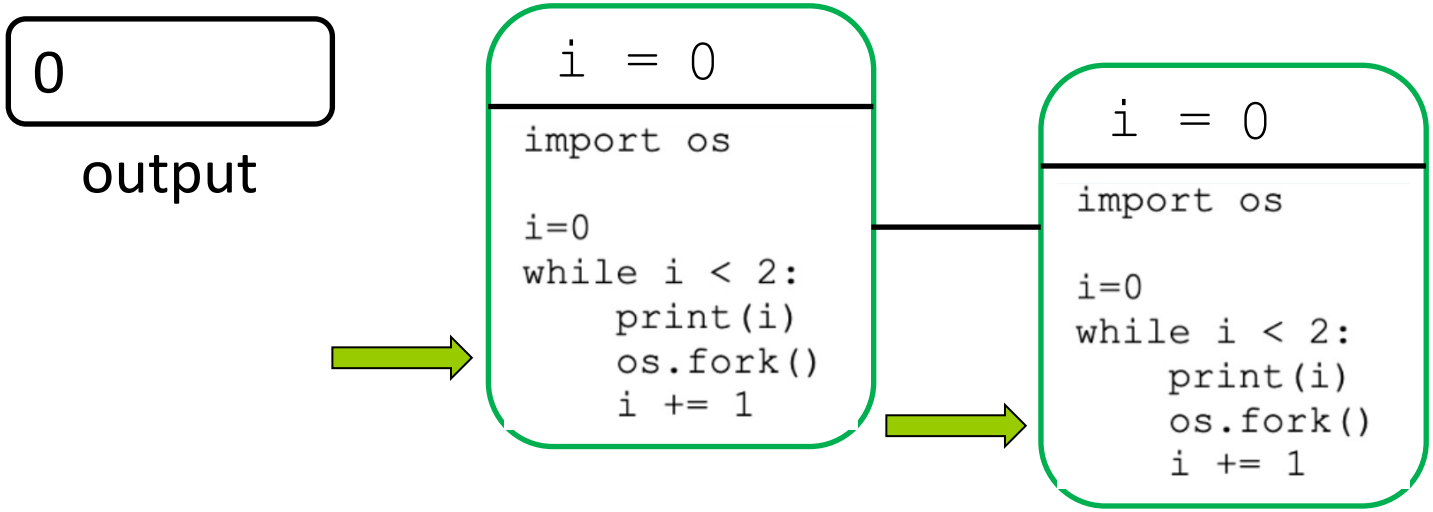

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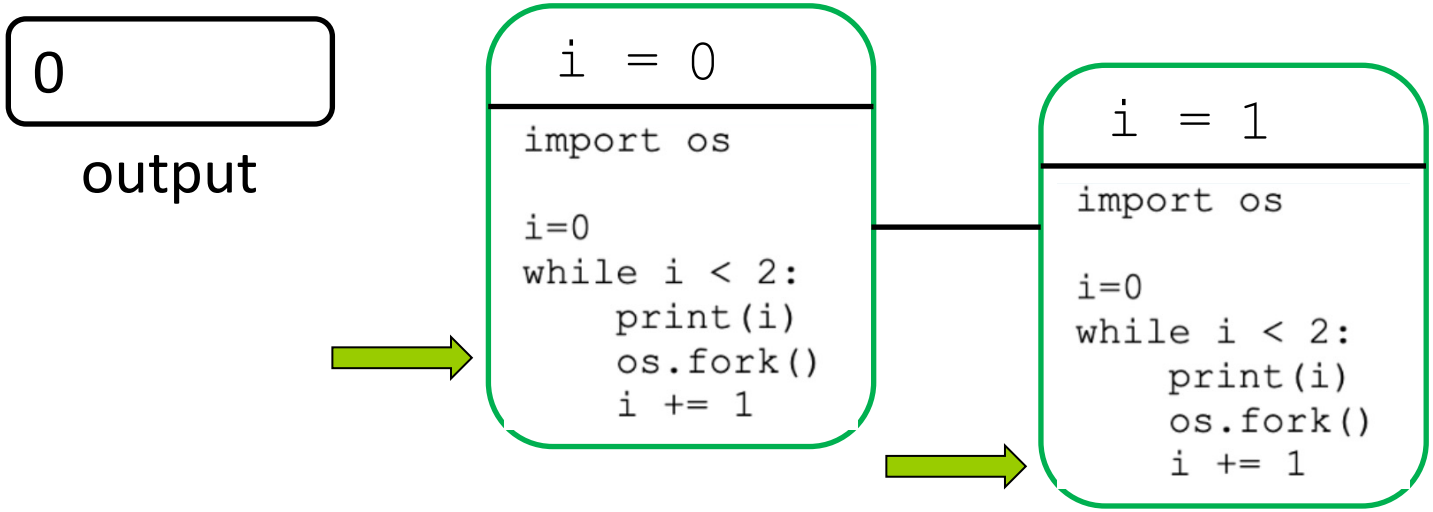

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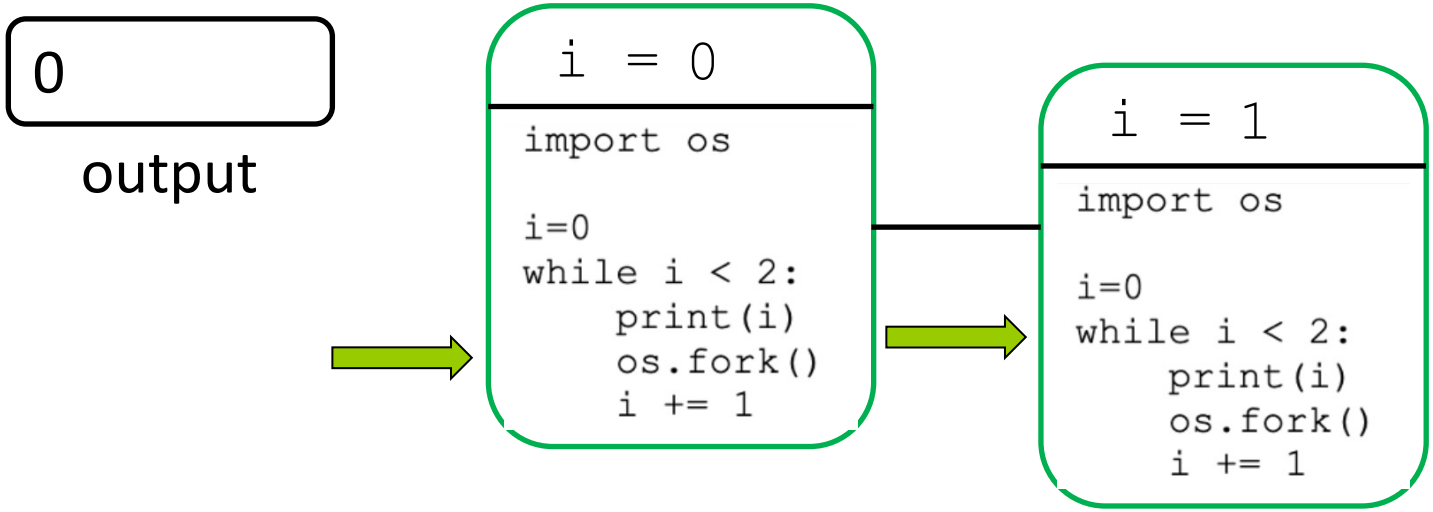

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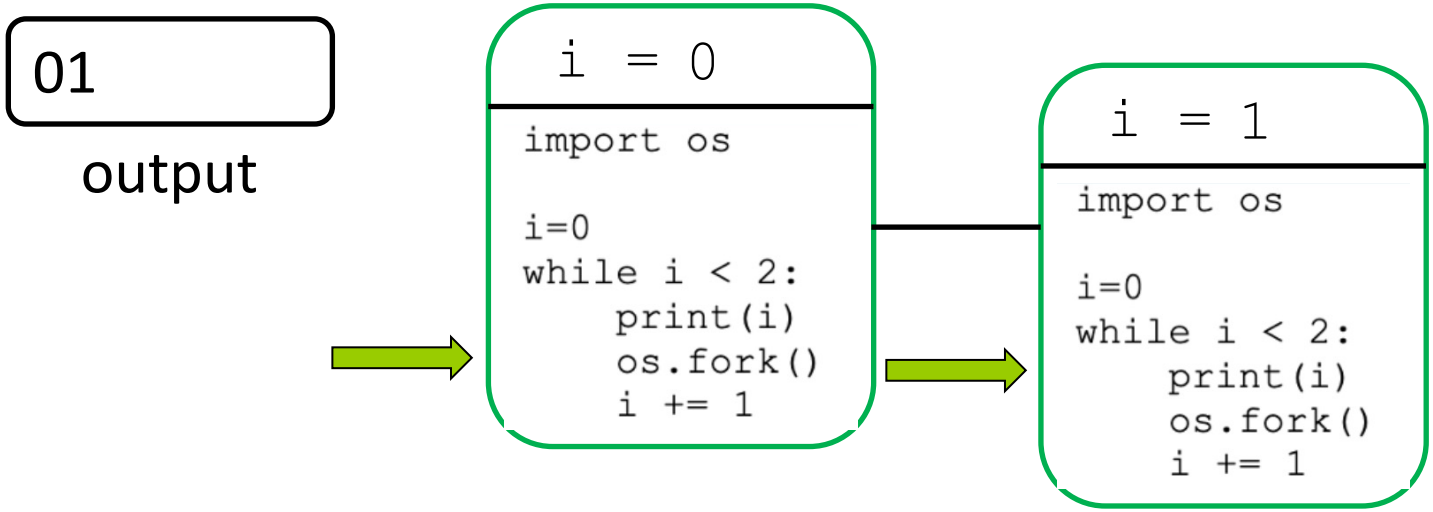

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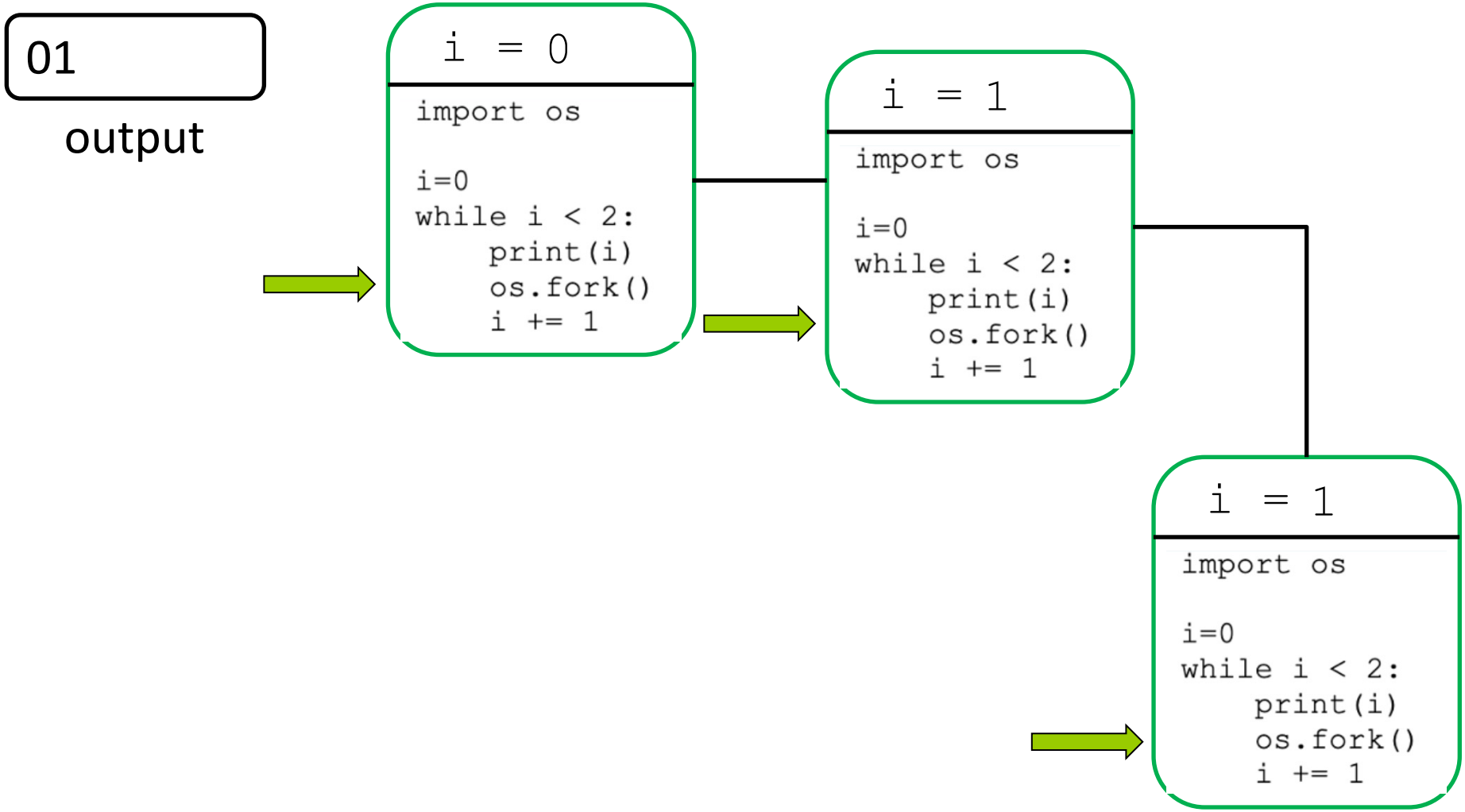

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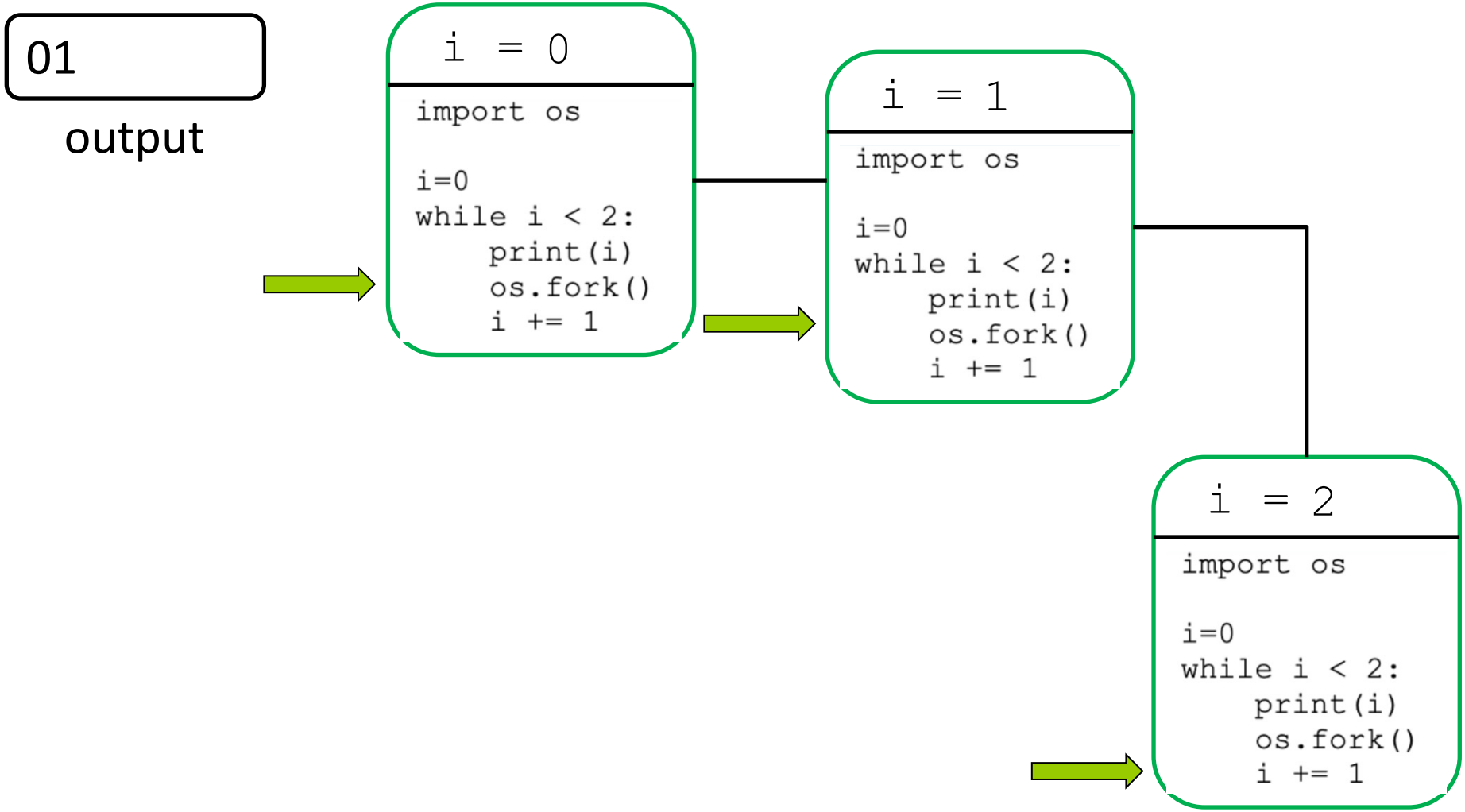

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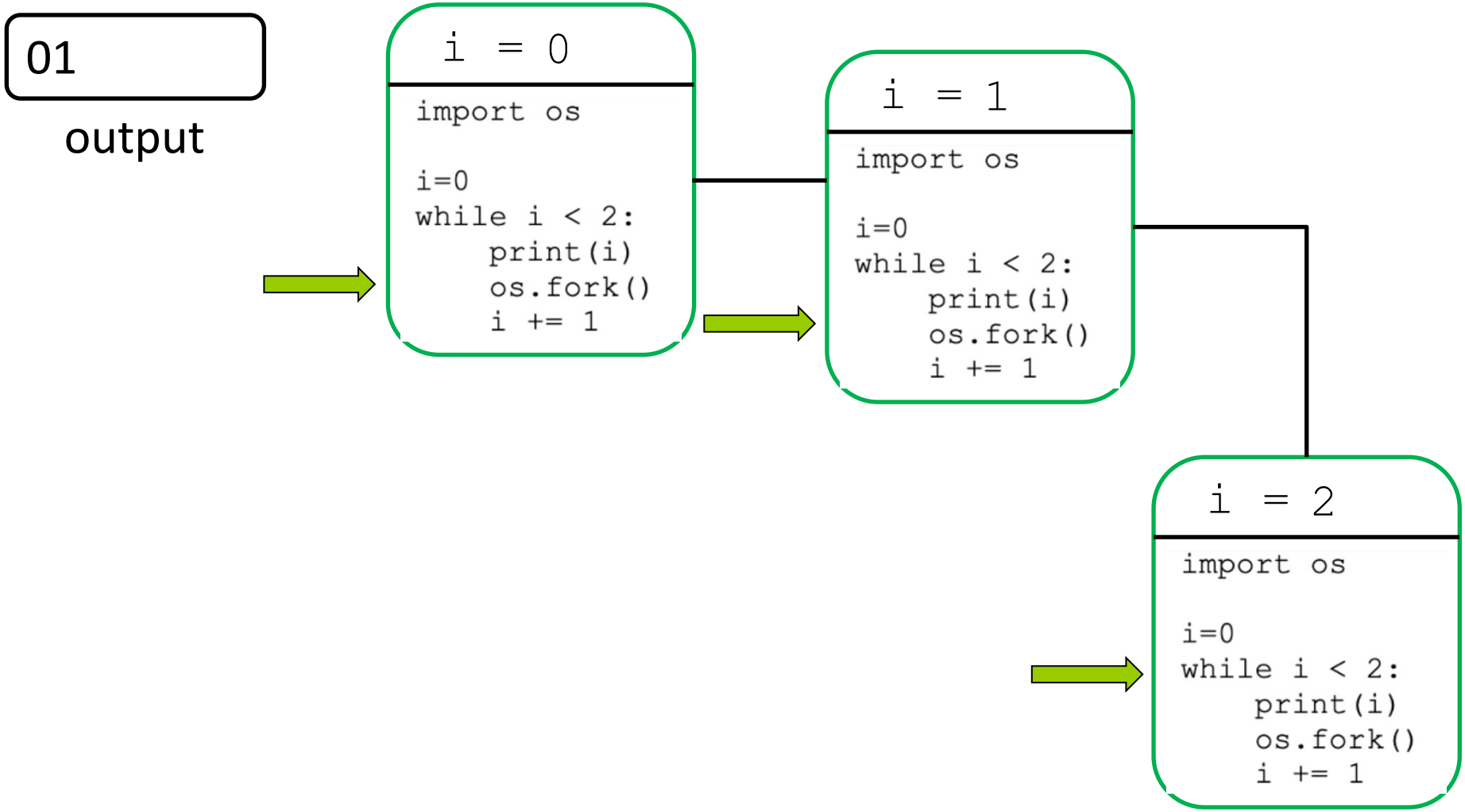

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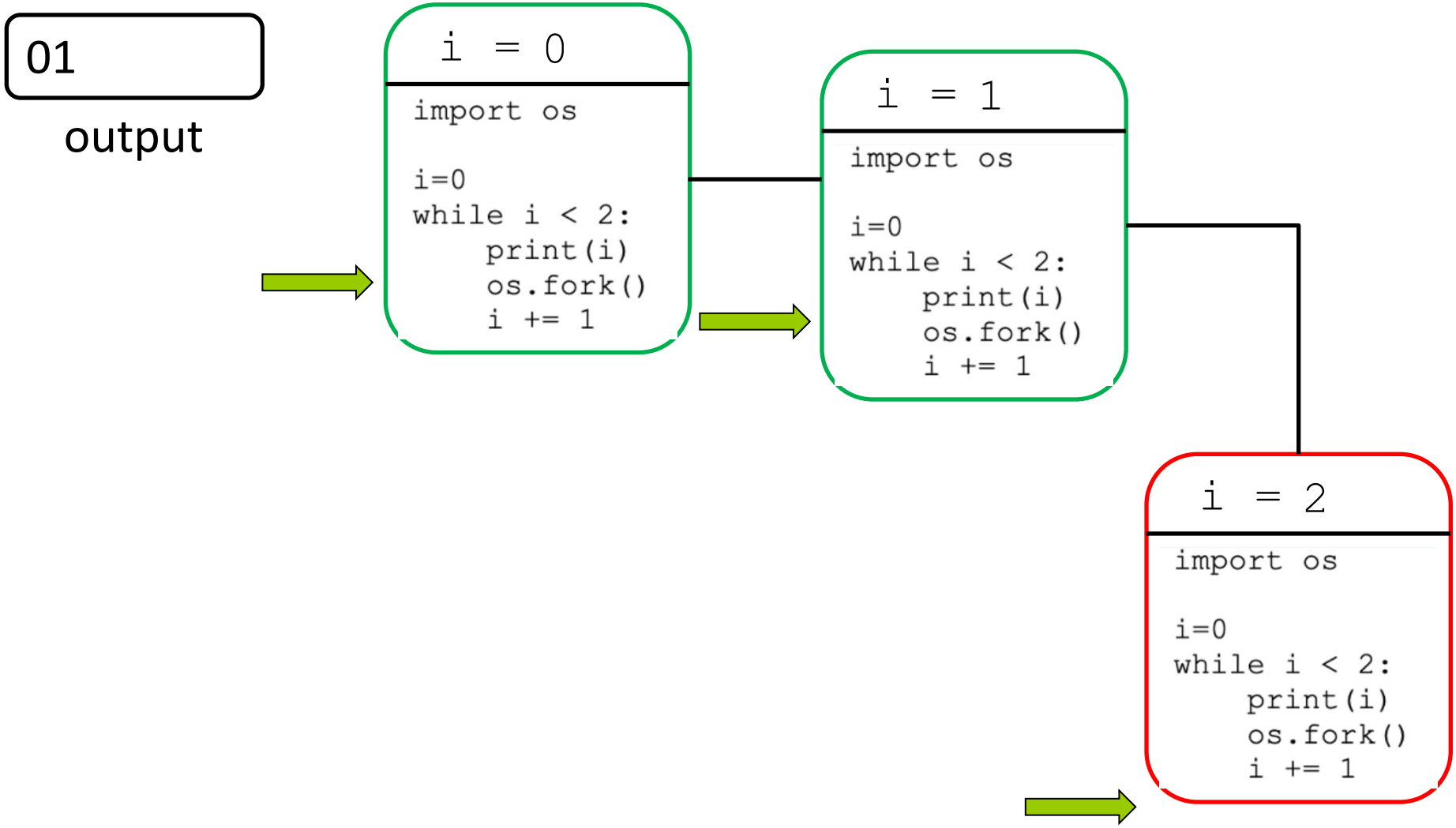

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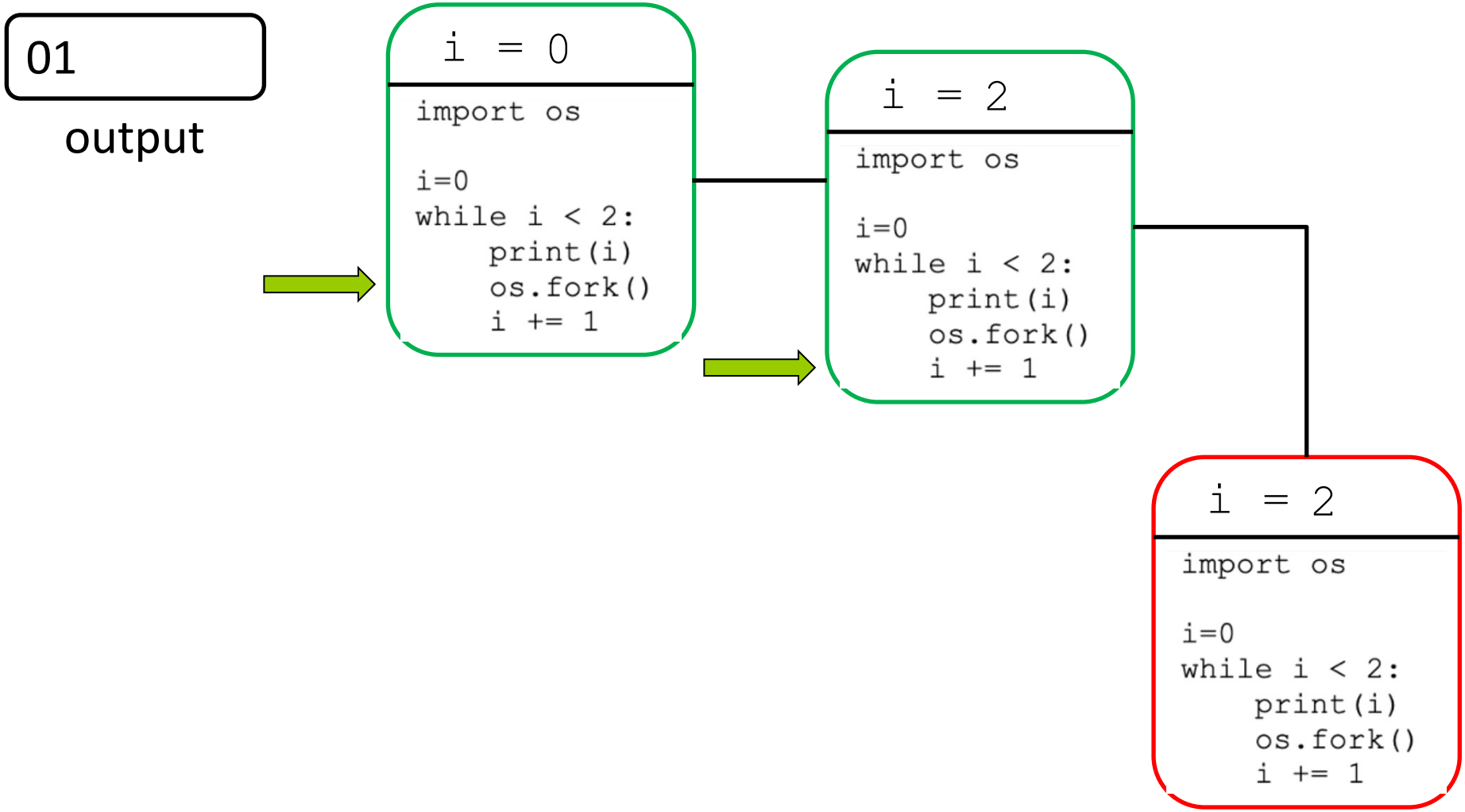

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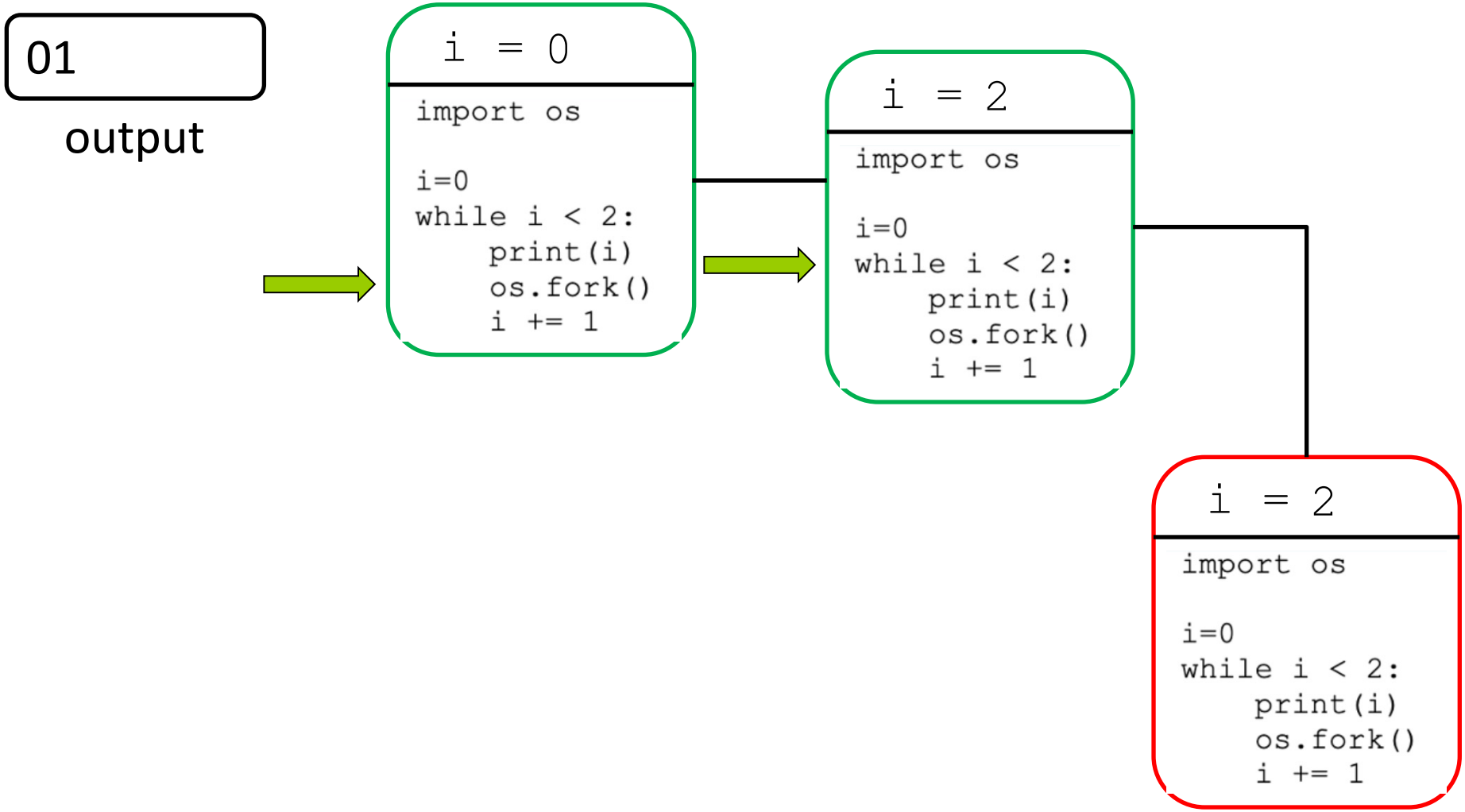

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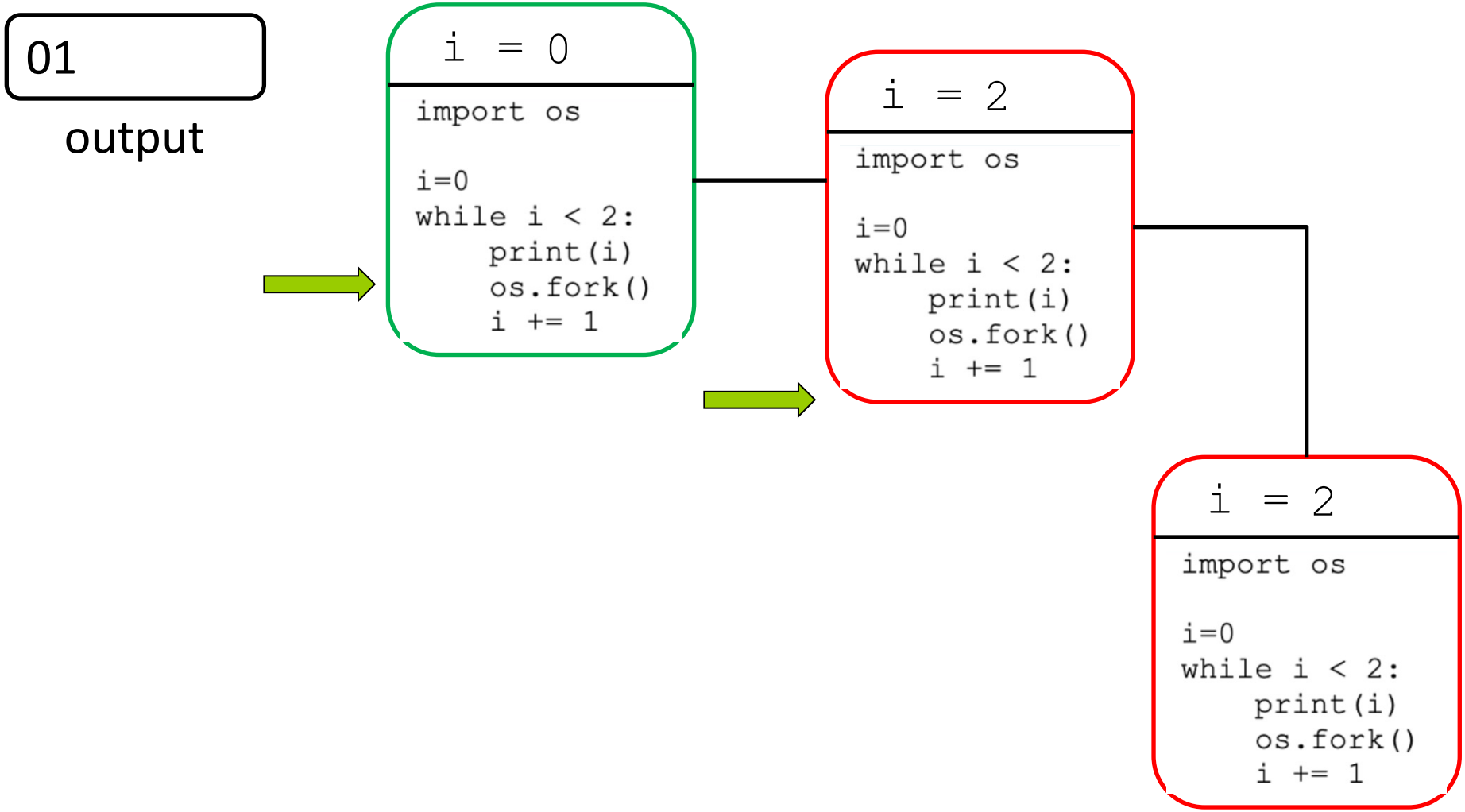

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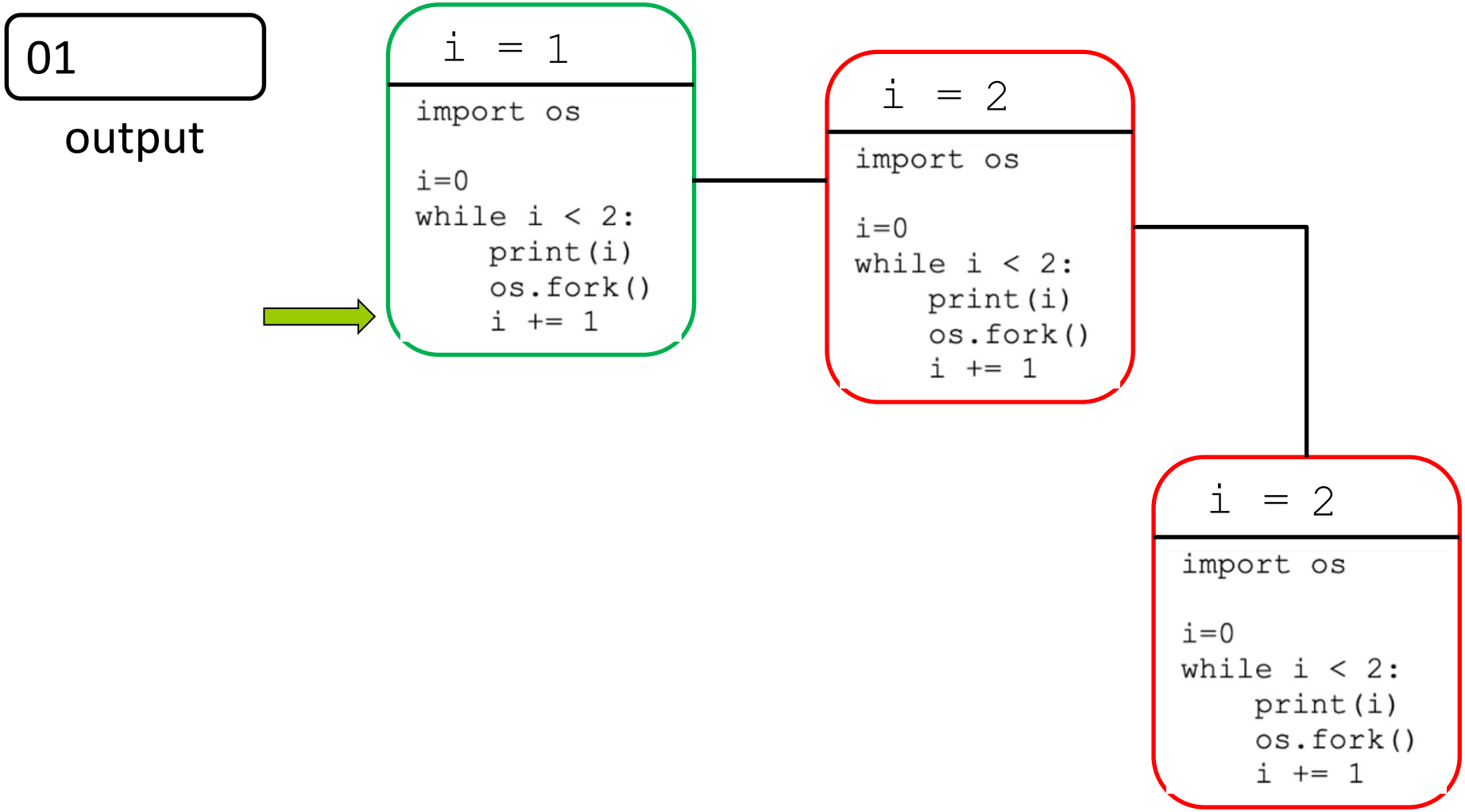

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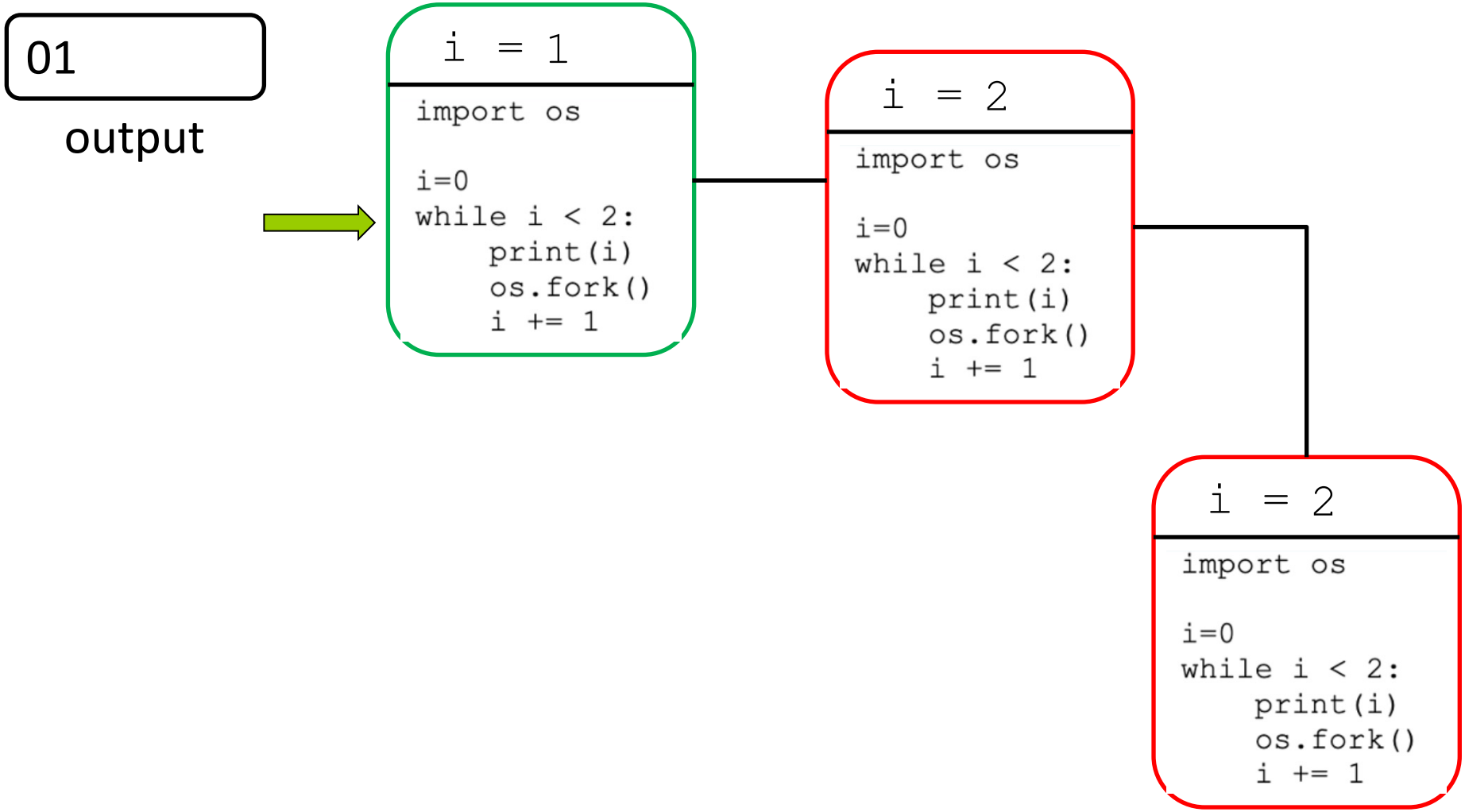

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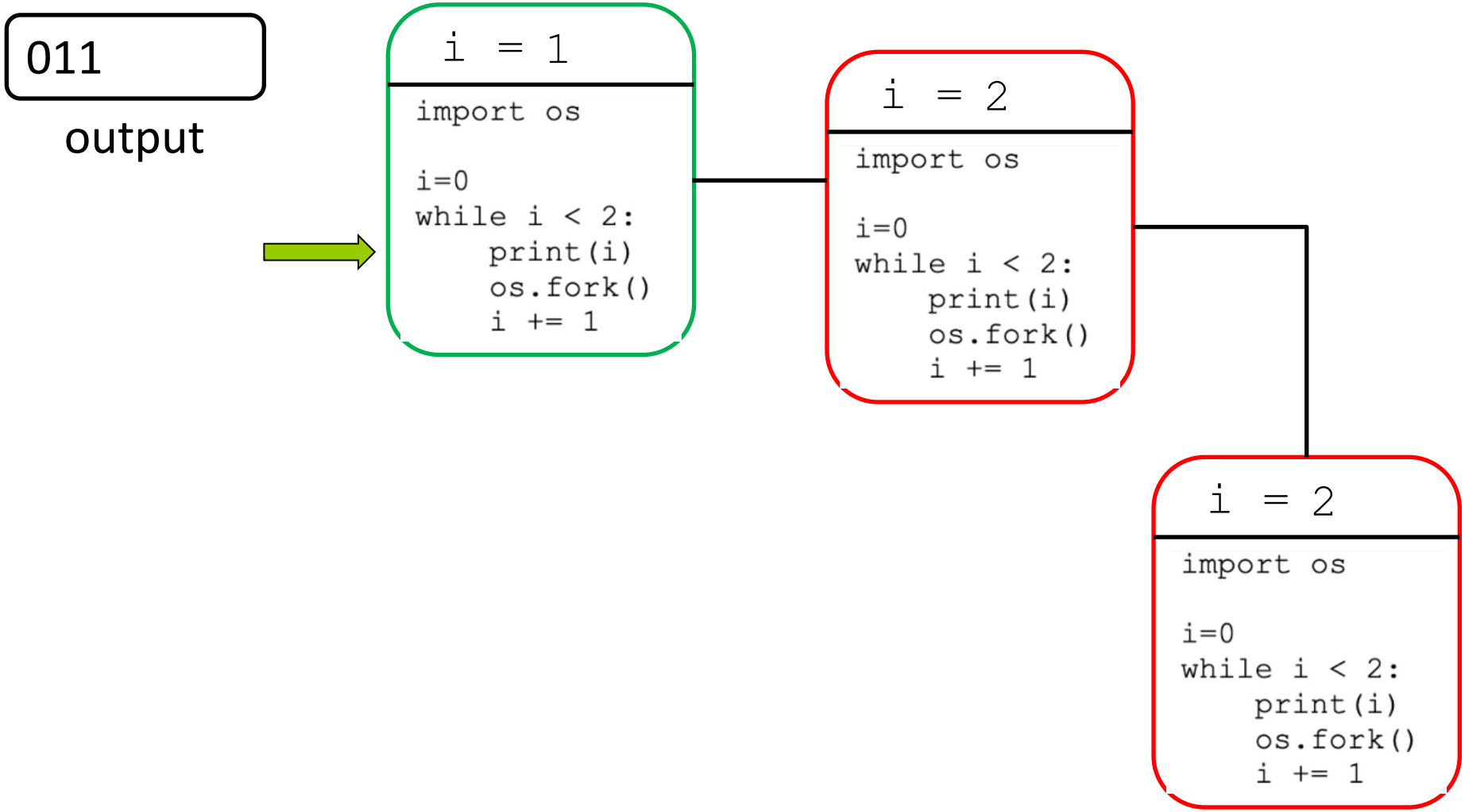

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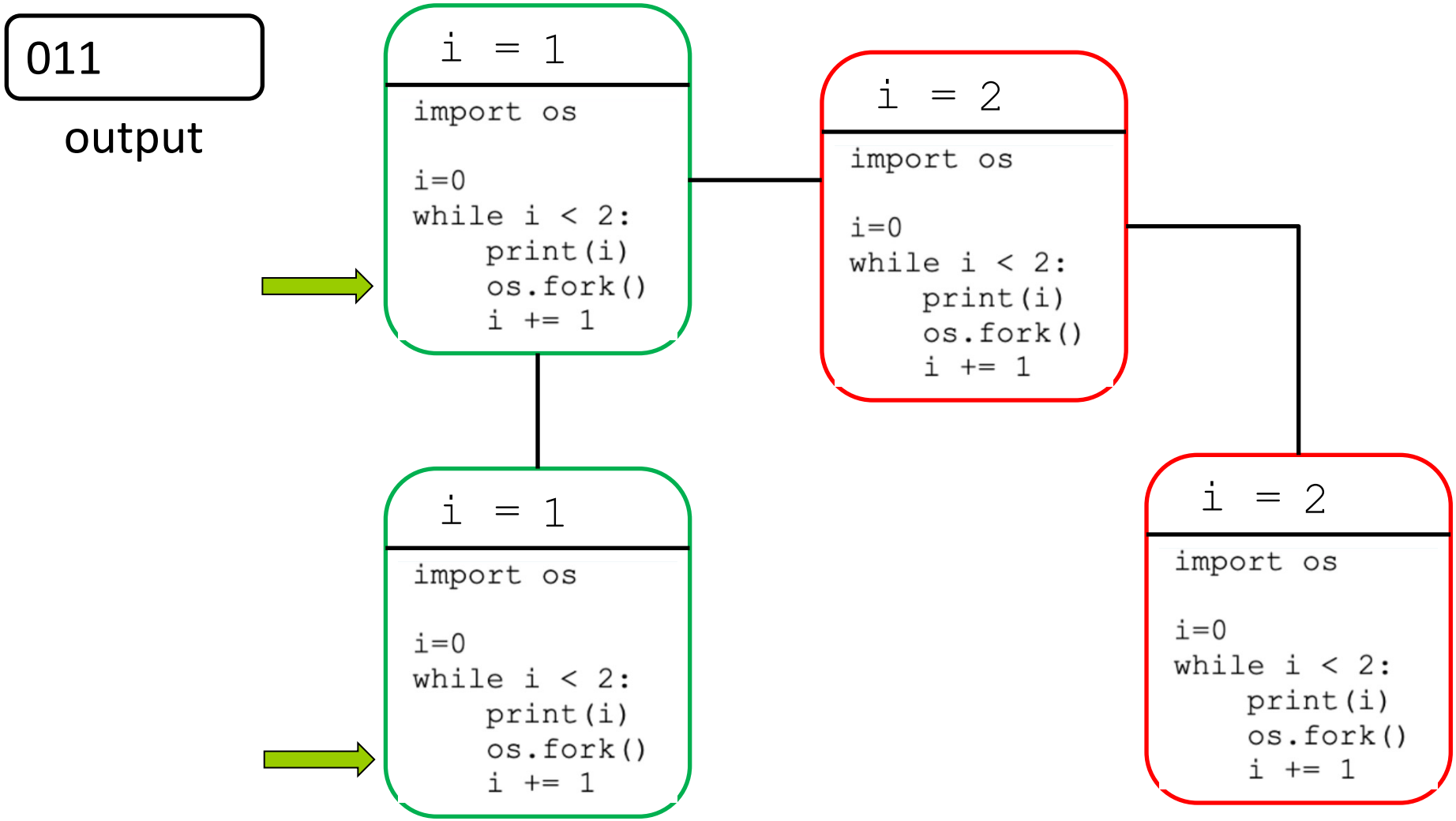

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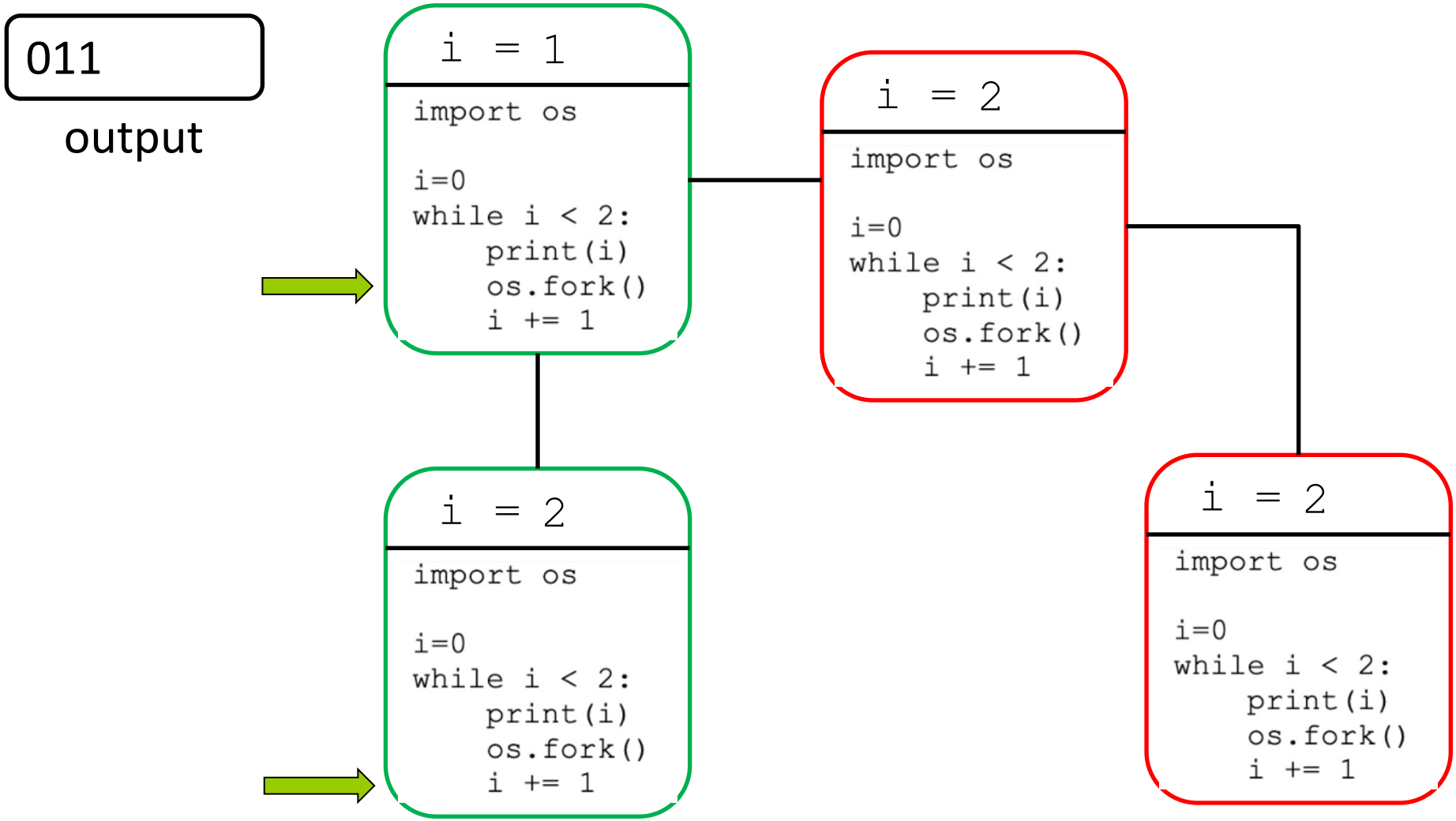

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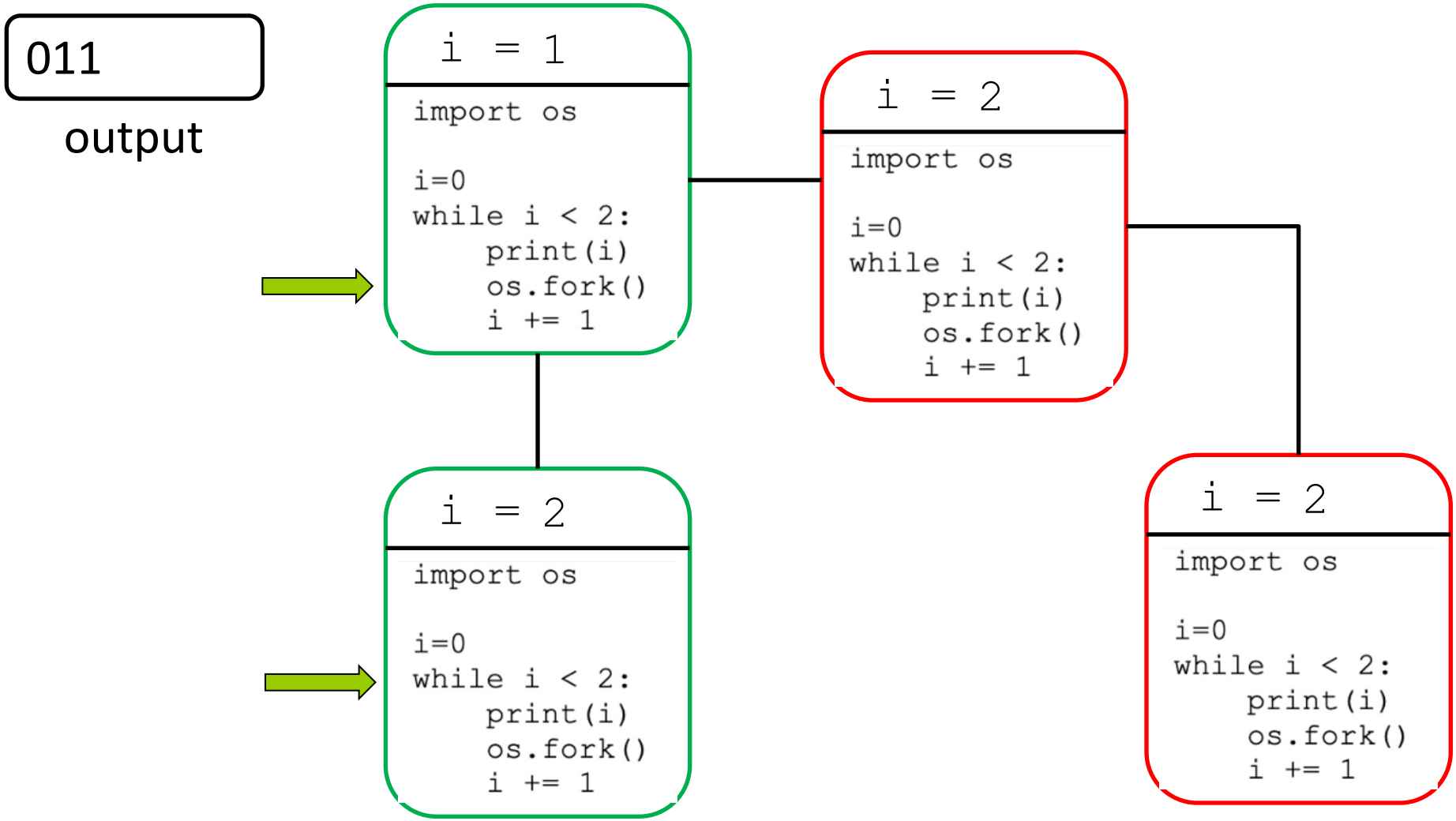

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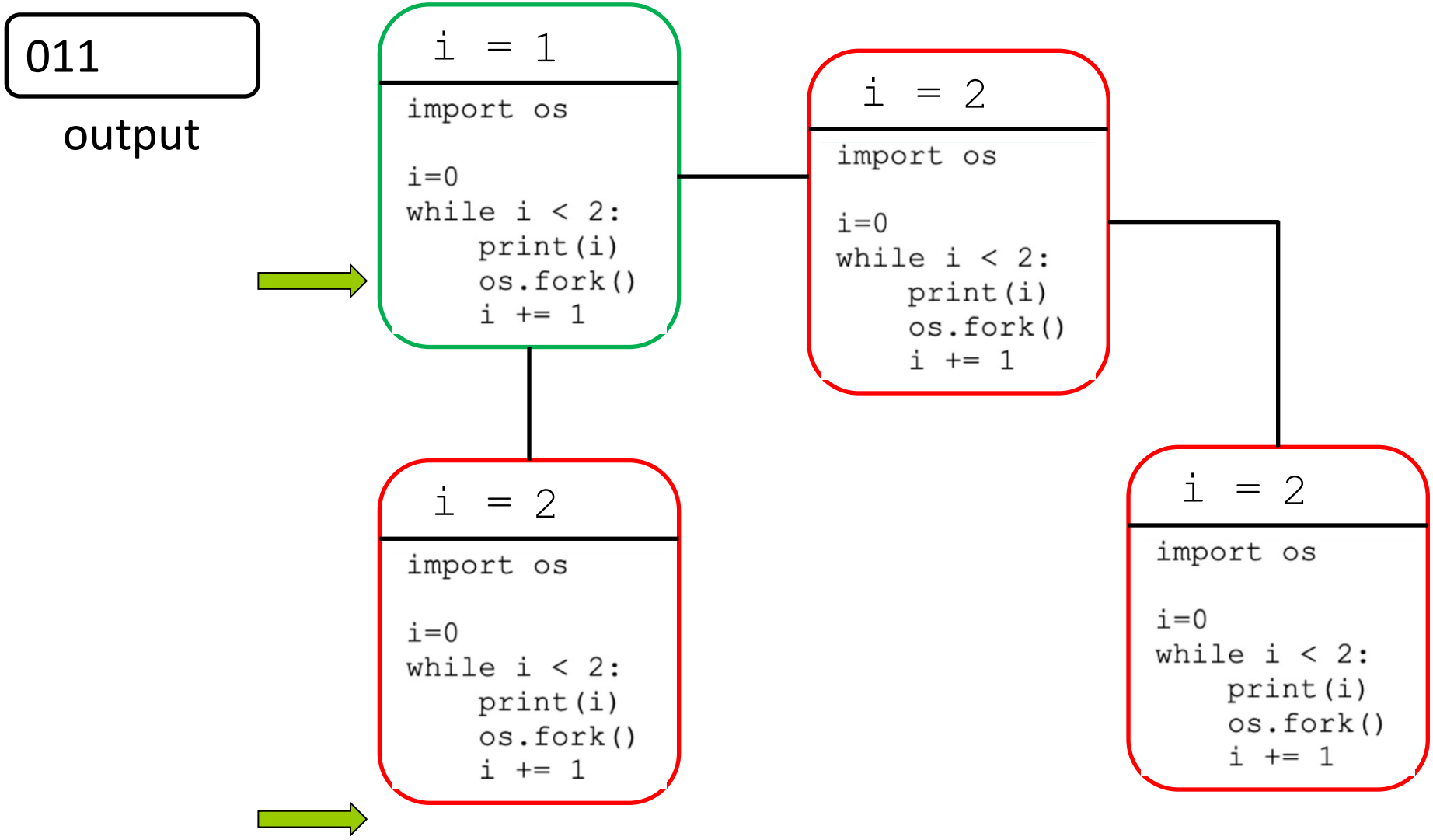

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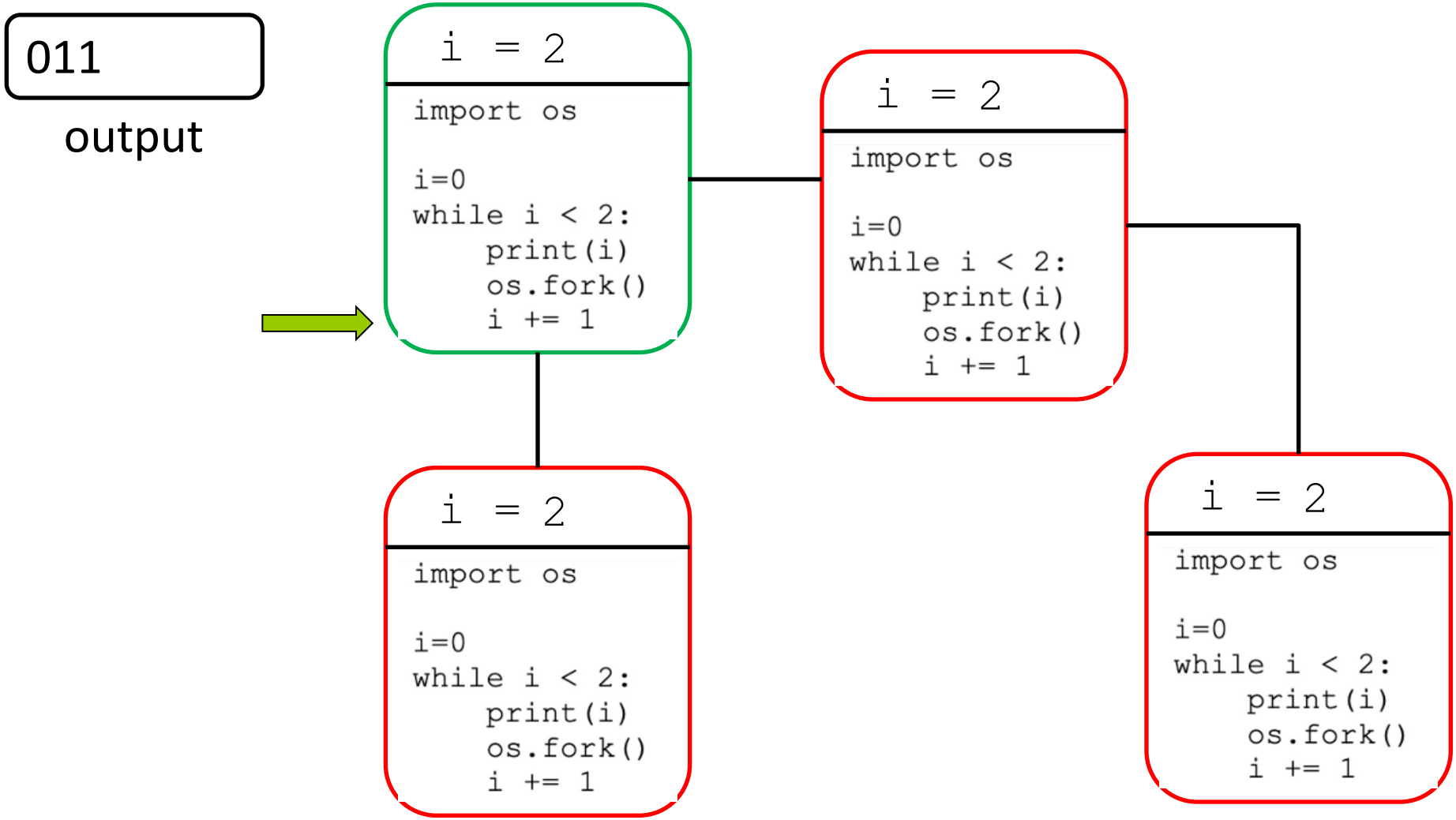

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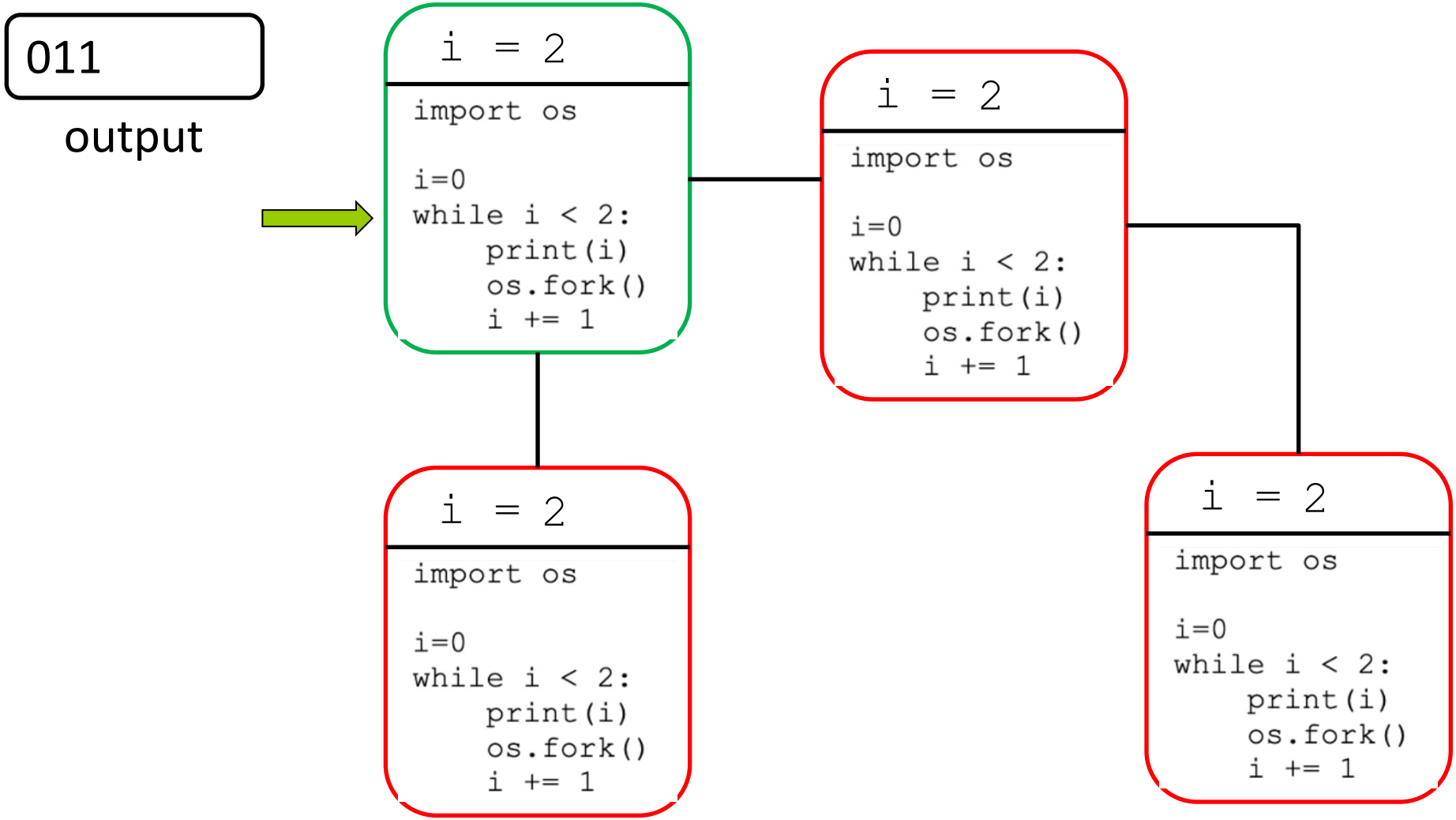

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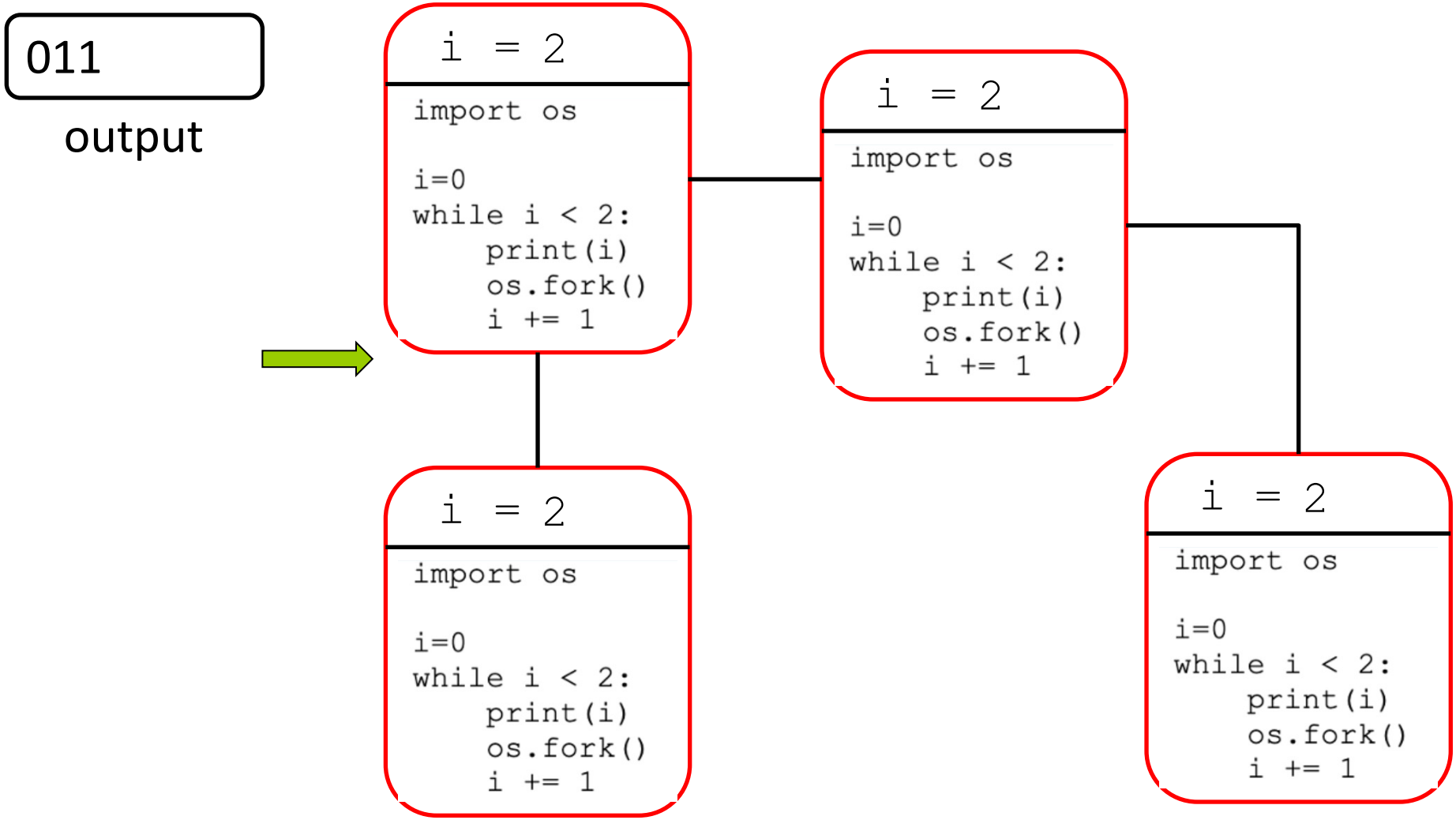


Sample exam question

۱. در اثر اجرای برنامه زیر چند پردازه ایجاد می‌شوند. روش محاسبه شما بایستی مشخص باشد و تنها یک عدد برای پاسخ کفایت نمی‌کند.

```
main(){
    forkthem(5);
}
void forkthem(int n){
    if( n >0 ) {
            fork();
            forkthem(n-1);
    }
}
```

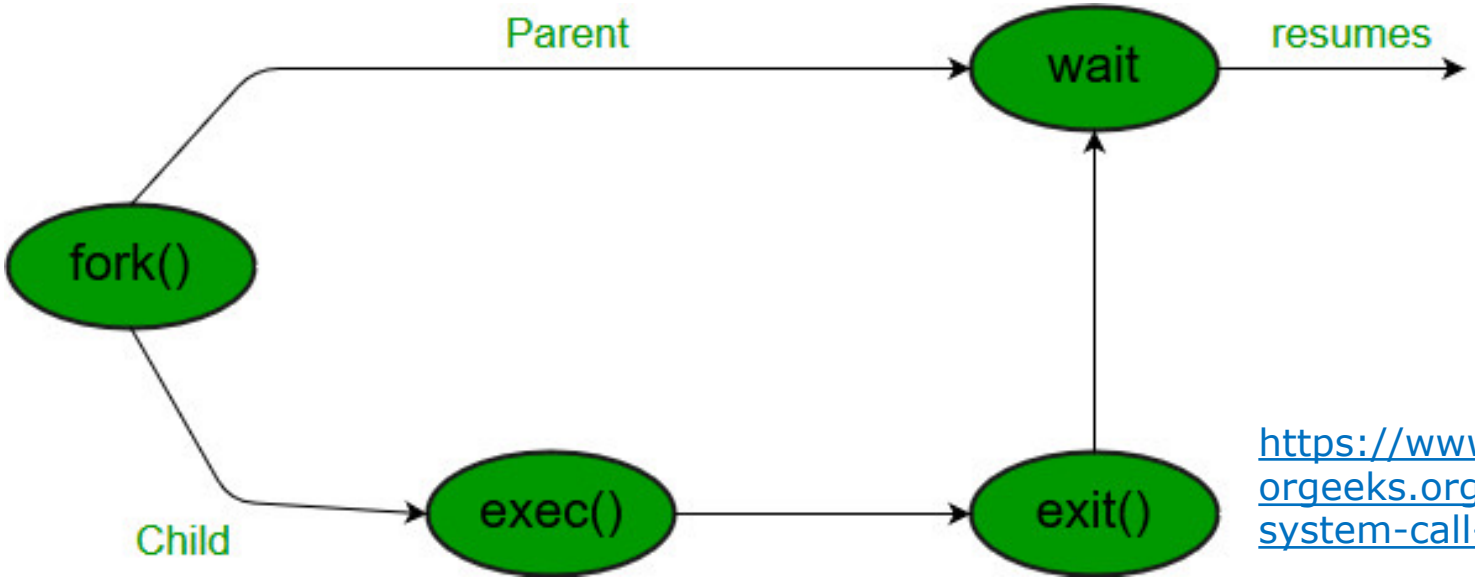
Sample exam question (cont.)

۲. خروجی برنامه‌های زیر چیست؟ به شکل خلاصه توضیح دهید.

```
// Program 1
main(){
    int val = 5;
    int pid;
    if (pid = fork())
            wait(pid);
    val++;
    printf ("%d\n", val);
    return val;
}
// Program 2
main(){
    int val = 5;
    int pid;
    if (pid = fork())
            wait(pid);
    else
            exit(val);
    val++;
    printf ("%d\n", val);
    return val;
}
```

Process Termination

- Process executes last statement and then asks the operating system to ***delete it*** using the **`exit()`** system call.
  - Returns status data from child to parent (via **`wait()`**)
  - Process' resources are deallocated by operating system.



https://www.geeksforgeeks.org/wait-system-call-c/

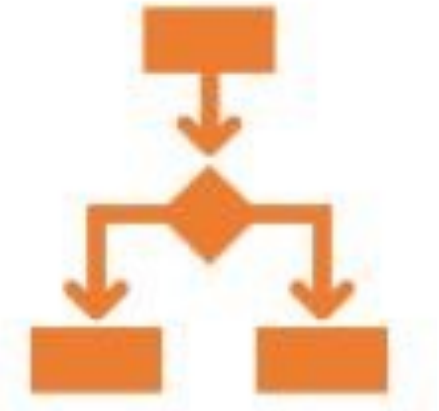
Process Termination (cont.)

- Parent may terminate the execution of children processes using the **`abort()`** system call.

- Some reasons for doing so:
  - Child has exceeded allocated resources.
  - Task assigned to child is no longer required.
  - The parent is exiting, and the operating systems does not allow a child to continue if its parent terminates.

Process Termination (cont.)

- Some OSs do not allow child to ***exists*** if its parent has terminated.
  - If a process terminates, then all its children must also be terminated.
  - **Cascading termination:** All children, grandchildren, etc., are terminated.
  - The termination is initiated by the operating system.



Process Termination (cont.)

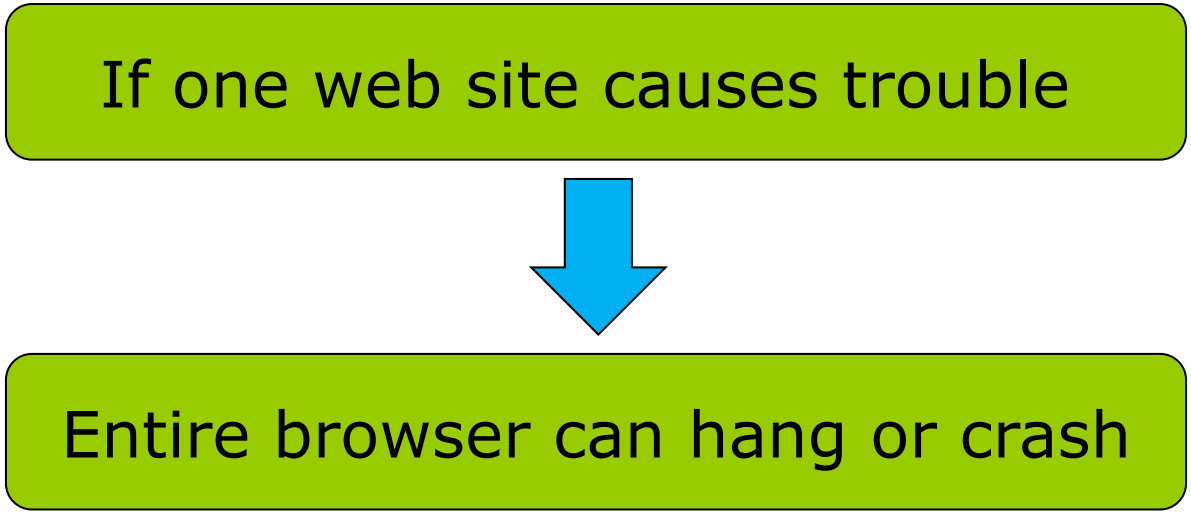
- The parent process may wait for termination of a child process by using the ***wait()*** system call.
  - The call returns status information and the pid of the terminated process.

pid = wait(&status);

- If no parent waiting (did not invoke wait()), process is a zombie.
- If parent terminated without invoking wait(), process is an orphan.

Multiprocess Architecture – Browser

- Many web browsers ran as single process (some still do)



Multiprocess Architecture – Chrome Browser (cont.)

- Google Chrome is multiprocess with 3 different types of processes:
  - Browser process manages user interface, disk and network I/O.
  - Renderer process renders web pages, deals with HTML, Javascript.
    - A new renderer created for each website opened
    - Runs in sandbox restricting disk and network I/O (why?)
  - Plug-in process for each type of plug-in.