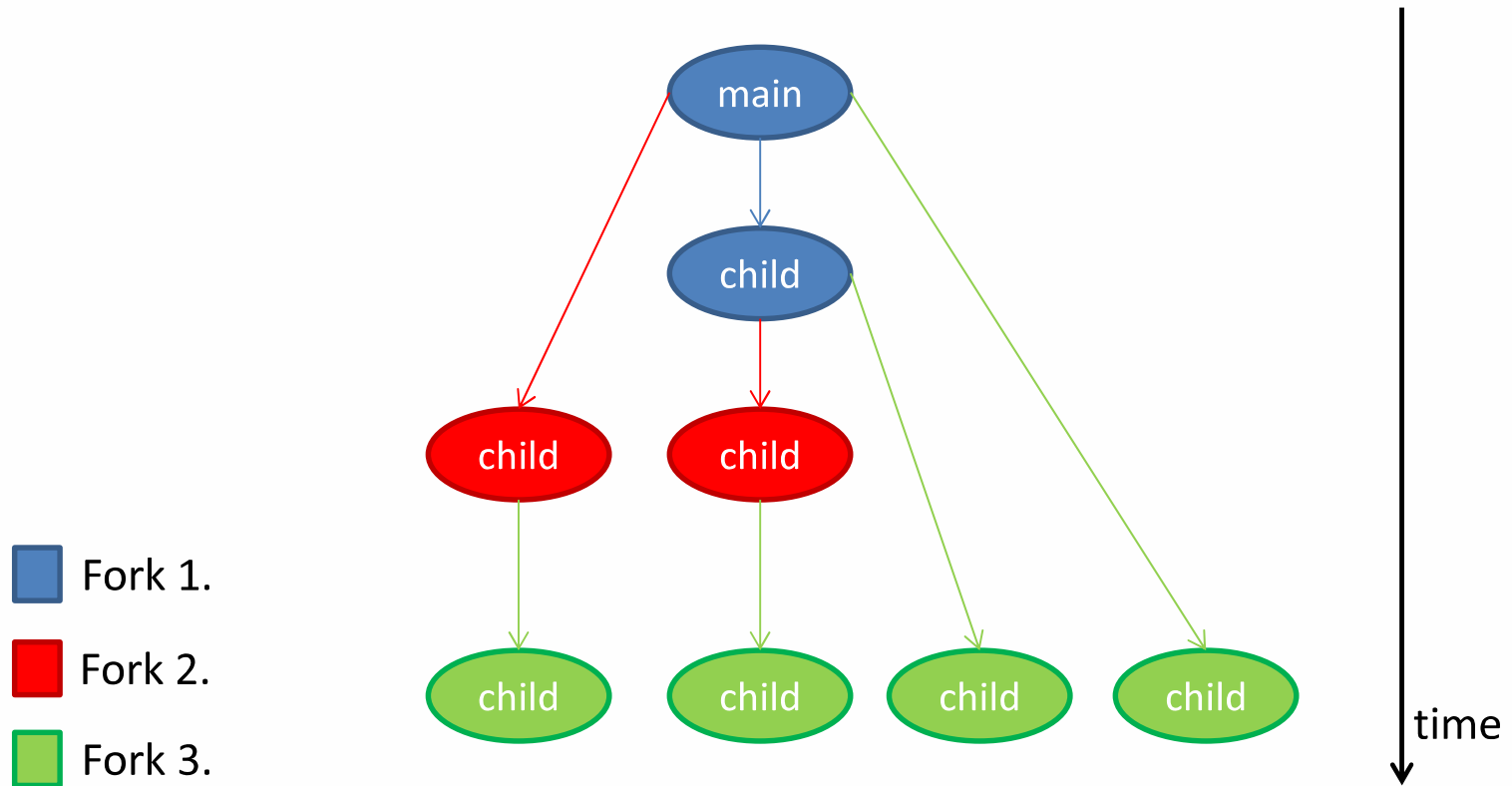


**HW1-1**

# Fork()

- 以此樹狀圖為框架，顯示每次fork後，現有process之間的關係。



# Fork()

- 輸出結果如下，輸出格式要與此例相同。

此行固定輸出 main process id

每行的輸出順序可與此例不同，  
但格式要與此例一致。



```
bsd1.cs.nctu.edu.tw - PuTTY
15:43 [redacted]@bsd1 [~/1050S/hw1/fork] > ./ThreeLevelFork.out
Main process ID : 48717

fork 1. I'm the child 48718, my parent is 48717.
fork 2. I'm the child 48719, my parent is 48718.
fork 3. I'm the child 48720, my parent is 48719.
fork 3. I'm the parent 48719, my child is 48720.
fork 2. I'm the parent 48718, my child is 48719.
fork 3. I'm the child 48721, my parent is 48718.
fork 3. I'm the parent 48718, my child is 48721.
fork 1. I'm the parent 48717, my child is 48718.
fork 2. I'm the child 48722, my parent is 48717.
fork 3. I'm the child 48723, my parent is 48722.
fork 3. I'm the parent 48722, my child is 48723.
fork 2. I'm the parent 48717, my child is 48722.
fork 3. I'm the child 48724, my parent is 48717.
fork 3. I'm the parent 48717, my child is 48724.
15:43 [redacted]@bsd1 [~/1050S/hw1/fork] > .....
```

# Fork()

- Hint : 

```
fork();  
wait(0); //選用
```

- Hint為程式需用到的部分。
- 程式邏輯正確即可。

**HW1-2**

# Fork() + exec() + pipe()

- 自行額外建置“計算階層”程式，ex: calculate.cpp。
- 該程式編譯後的檔名“固定”為calculate.out。
- 階層定義：
  - $N! = N * (N-1) * (N-2) * \dots * 3 * 2 * 1$
  - $0! = 1! = 1$

# Fork() + exec() + pipe()

- Parent 生出child後，讓child呼叫calculate.out計算階層，等所有child計算完畢後，則由parent將所有輸出結果加總。
- Parent與child之間的溝通請透過pipe。
- 僅需parent\*1、child\*3。

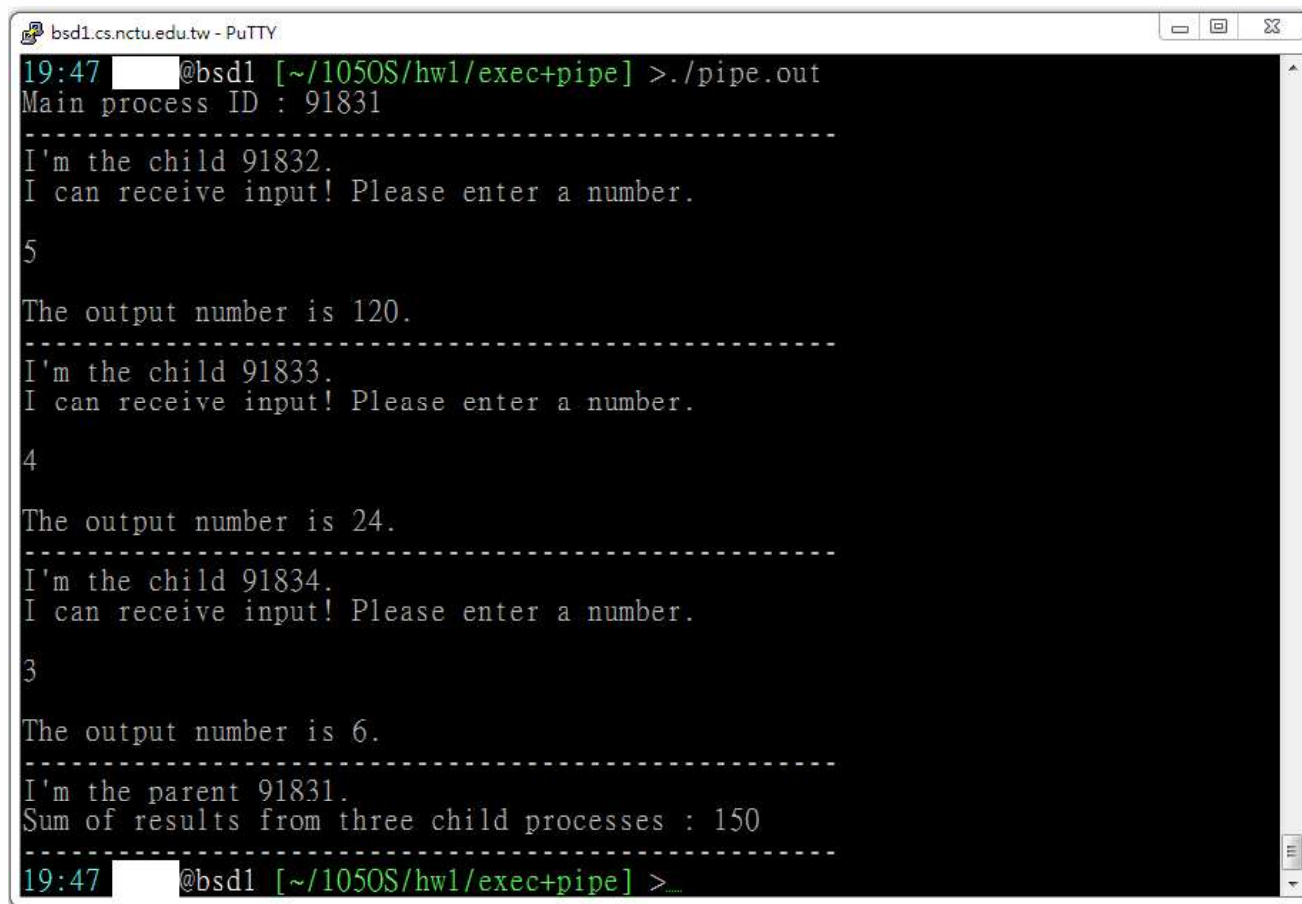
# Fork() + exec() + pipe()

- Parent process
  - Input :
    - N! from child process
  - Output :
    - Process id
    - Sum of results from three child processes
- Child process
  - Input :
    - Allow user to enter a number N ( $N \geq 0$ )
  - Output :
    - Process id
    - N!



# Fork() + exec() + pipe()

- 整體輸出如下。



```
bsd1.cs.nctu.edu.tw - PuTTY
19:47 [redacted]@bsd1 [~/105OS/hw1/exec+pipe] > ./pipe.out
Main process ID : 91831
-----
I'm the child 91832.
I can receive input! Please enter a number.
5
The output number is 120.
-----
I'm the child 91833.
I can receive input! Please enter a number.
4
The output number is 24.
-----
I'm the child 91834.
I can receive input! Please enter a number.
3
The output number is 6.
-----
I'm the parent 91831.
Sum of results from three child processes : 150
-----
19:47 [redacted]@bsd1 [~/105OS/hw1/exec+pipe] >
```

# Fork() + exec() + pipe()

- Hint : 

```
fork();  
pipe();  
execl("calculate.out", "./calculate.out", (char *)0); //範例  
wait(0); //選用
```