Introduction to Operating Systems and SQL for Data Science

Practice 1 – Processes

What is a process?

- A process is an instance of a computer program that is being executed

- Code + Memory

- Types of processes:
  - Foreground
  - Background

Reichman
University

Process – C#

```csharp
Process myProcess = new Process();

myProcess.StartInfo.WorkingDirectory =
"C:\\Windows\\System32";

myProcess.StartInfo.FileName = "Notepad.exe";

myProcess.Start();
```

https://msdn.microsoft.com/en-us/library/ccf1tfx0.aspx

Fork - Linux

- Fork is a system call in Linux for creating a new process

- New created process runs the same code as creator process

- The memory of the father process is copied to the son process

- Return value of fork:
  - On success:
    - For father process – Pid (process id) of the created son process
    - For son process – 0
  - On failure: return value for father process is -1. No child process created.
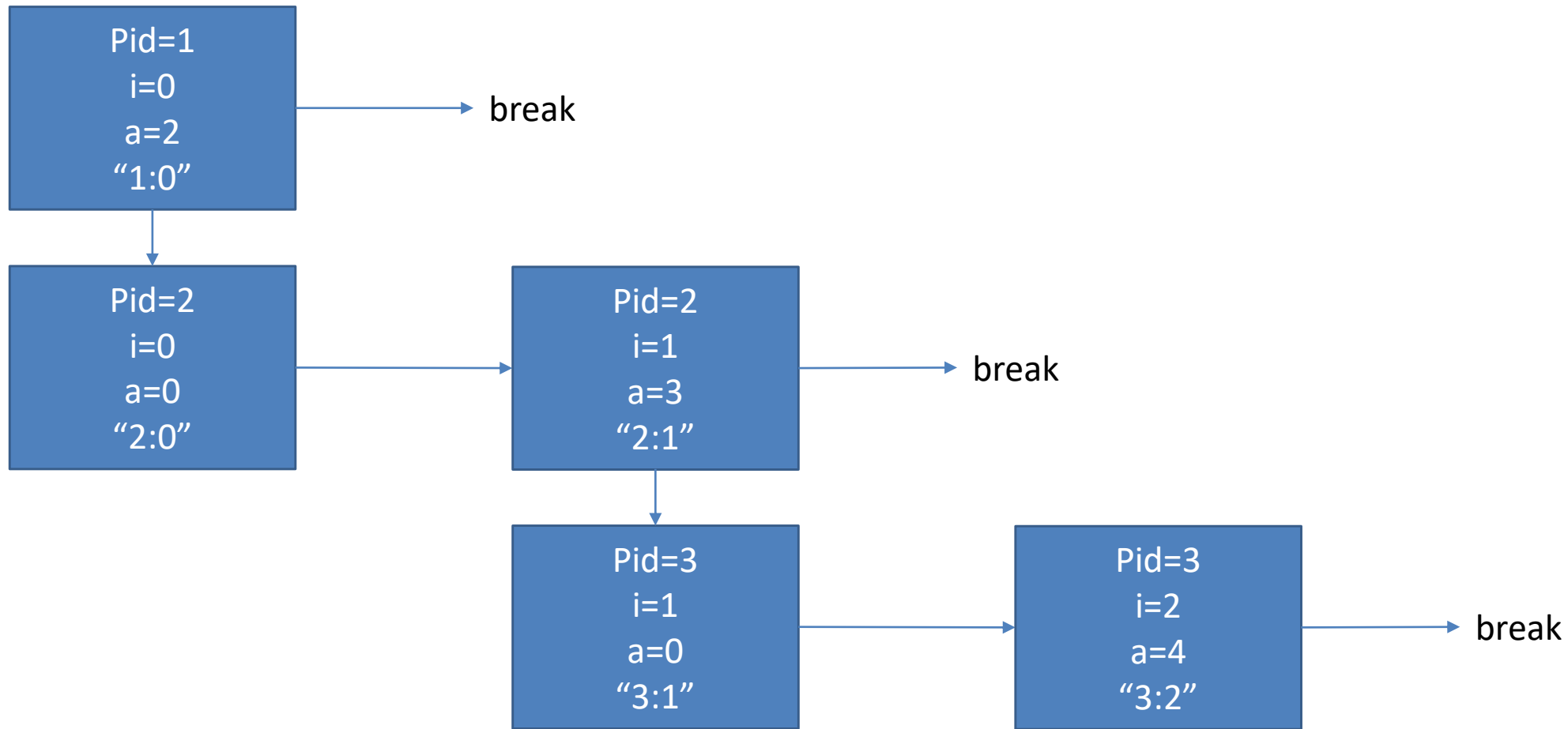
Fork – code example

```
Public Main(){
        for(int i=0; i<7; i++){
                int a = fork();
                print(pid + ":" + I + ",");
                if(a>0)                 i instead of I
                        break;
        }

}
```

Assumptions:
- Pid of staring process is 1
- Pids are given incrementally
- No other processes are running in the system

Questions:
- What is the highest Pid allocated?
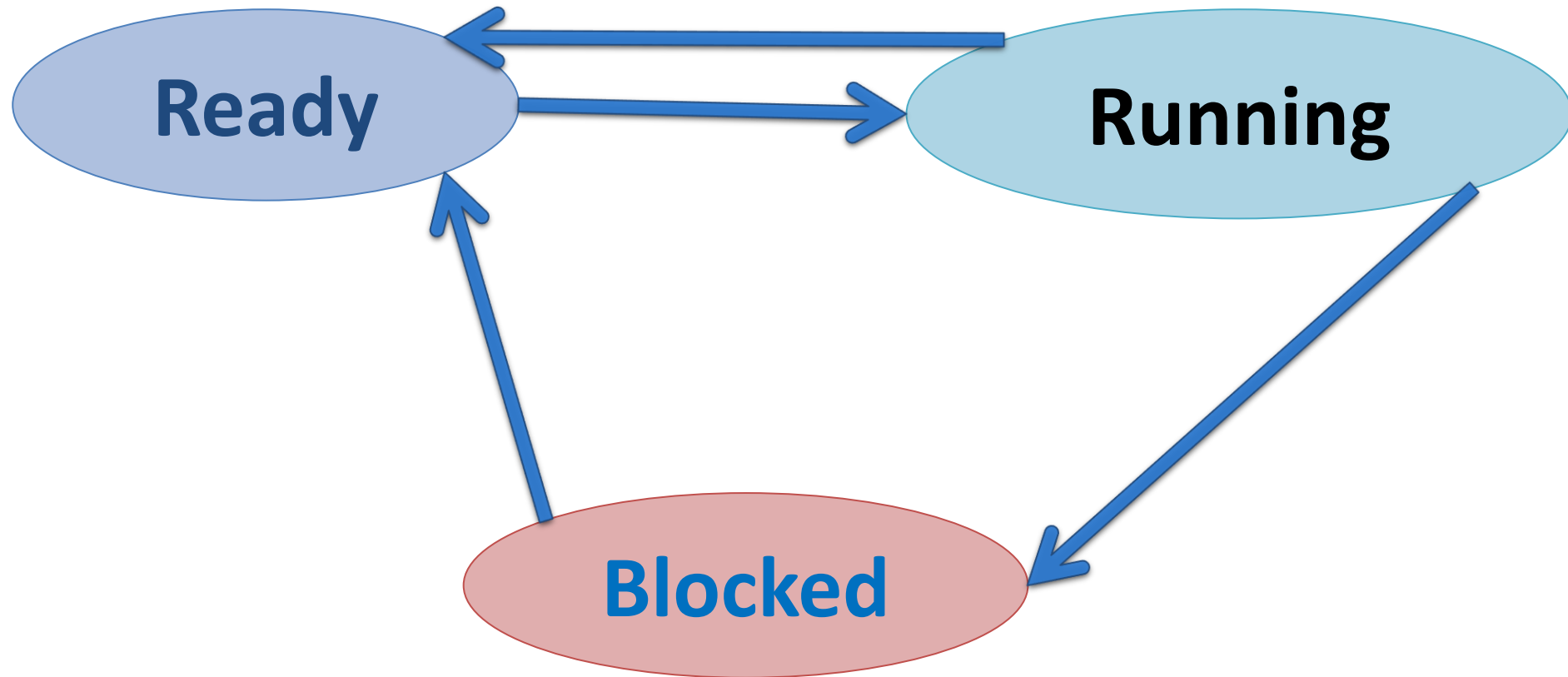- What will be the output?

Solution

1. Highest Pid allocated is 8

2. The output would be:

   1:0,2:0,2:1,3:1,3:2,4:2,4:3,5:3,5:4,6:4,6:5,7:5,7:6,8:6

   Not necessarily in this order

Process states:

waiting for some kind of input/answer

System utilization - Question

- In t_0 3 process arrive:
  - P1 is 40% busy writing to the printer
  - P2 is 25% busy writing to the disk
  - P3 is 50% busy reading from the disk

  - When all processes are active, which part of the time each of them are: ready, running, blocked?

  - Repeat the question with following priority:
    - P1 with priority 2.
    - P2 with priority 3.
    - P3 with priority 1.

Solution

Without priorities:

	IO	blocked	ready	running
P1	40%	0.4	0.3	0.3
P2	25%	0.25	0.3375	0,4125
P3	50%	0.5	0.2665	0.2375

With priorities:

	IO	Priority	blocked	ready	running
P1	40%	2	0.4	0.45	0.15
P2	25%	3	0.25	0	0.75
P3	50%	1	0.5	0.45	0.05

Solution

Marks:

- $P(pi = B)$ probability of process i to be blocked

- $P(pi = R)$ probability of process i to run

- $P(pi = \neg B)$ probality of process I to be read

Solution

Without priorities:

- $P(p1 = R) = P(p1 = \neg B) * (P(p2 = B) * P(p3 = B) + P(p2 = \neg B) * P(p3 = B) * 0.5 + P(p2 = B) * P(p3 \neg= B) * 0.5 + P(p2 = \neg B) * P(p3 \neg= B) * \frac{1}{3})$

- $P(p2 = R) = P(p2 = \neg B) * (P(p1 = B) * P(p3 = B) + P(p1 = \neg B) * P(p3 = B) * 0.5 + P(p1 = B) * P(p3 \neg= B) * 0.5 + P(p1 = \neg B) * P(p3 \neg= B) * \frac{1}{3})$

- $P(p3 = R) = P(p3 = \neg B) * (P(p1 = B) * P(p2 = B) + P(p1 = \neg B) * P(p2 = B) * 0.5 + P(p1 = B) * P(p2 \neg= B) * 0.5 + P(p1 = \neg B) * P(p2 \neg= B) * \frac{1}{3})$

Solution

With priorities:

- $P(p1 = R) = P(p1 = \neg B) * P(p2 = B)$

- $P(p2 = R) = P(p2 = \neg B)$

- $P(p3 = R) = P(p3 = \neg B) * P(p1 = B) * P(p2 = B)$