

Title: Process Creation and Management Using Python OS Module
Course Code: ENCS351 – Operating System
Program: B.Tech CSE
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Lab Sheet 1

Objective

To simulate Linux process management operations using Python to understand process creation, execution, and control, including `fork()`, `exec()`, zombie/orphan behavior, and scheduling via `nice` values.

Tools Used

- Python 3.x
 - Linux Environment (Ubuntu / WSL)
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Tasks Performed

Task 1: Created multiple child processes using `os.fork()`.

Task 2: Executed system commands using `os.execvp()`.

Task 3: Simulated Zombie and Orphan processes and observed using `ps -el | grep defunct`.

Task 4: Inspected process details using `/proc/[pid]/status`, `/exe`, `/fd`.

Task 5: Created CPU-intensive tasks with different `nice()` values to observe scheduling impact.

Outputs

- Successfully displayed parent–child relationships.
 - Verified zombie/orphan states.
 - Retrieved process details from `/proc`.
 - Observed the difference in execution time based on process priority.
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Learning Outcomes

- Understood process lifecycle and management in OS.
- Demonstrated process creation and execution flow.
- Observed how Linux manages zombies and orphans.
- Learned how nice values affect CPU scheduling.

Complexity

- Time Complexity: $O(n)$ for n processes
- Space Complexity: $O(n)$ for maintaining process info

Conclusion

This experiment deepened understanding of process management concepts in Linux by practically demonstrating process creation, control, and scheduling through Python's OS module.

Screenshots

```
> TERMINAL
Python + - [ ] [ ] ...
● lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 % /usr/local/bin/python3 "/Users/lavyakumarberiwala/Lab sheet 1/process_management.py"
=== OS LAB EXPERIMENT: PROCESS MANAGEMENT ===
Select a Task to Run:
1. Process Creation
2. Command Execution
3. Zombie & Orphan Simulation
4. /proc Inspection
5. Process Prioritization

Enter task number (1-5): 1

--- TASK 1: Process Creation Utility ---

Child 1: PID=3619, Parent PID=3614
Custom Message: Hello from Child 1!
Child 2: PID=3620, Parent PID=3614
Custom Message: Hello from Child 2!
Child 3: PID=3621, Parent PID=3614
Custom Message: Hello from Child 3!
All child processes have finished.

● lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 % /usr/local/bin/python3 "/Users/lavyakumarberiwala/Lab sheet 1/process_management.py"
=== OS LAB EXPERIMENT: PROCESS MANAGEMENT ===
Select a Task to Run:
1. Process Creation
2. Command Execution
3. Zombie & Orphan Simulation
4. /proc Inspection
5. Process Prioritization

Enter task number (1-5): 2

--- TASK 2: Command Execution Using exec() ---

Executing 'ls' in child PID=3757
process_management.py

Executing 'date' in child PID=3758
Mon Oct 6 21:24:14 IST 2025

Executing 'ps' in child PID=3759
PID TTY TIME CMD
1331 ttys001 0:00.01 /bin/zsh
1333 ttys003 0:00.02 /bin/zsh -i
1334 ttys005 0:00.02 /bin/zsh -i
1335 ttys007 0:00.02 /bin/zsh -i
1336 ttys009 0:00.02 /bin/zsh -i
1337 ttys011 0:00.02 /bin/zsh -i
```

```
> ▾ TERMINAL Python + ▾ □ □ □ ...
lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 % /usr/local/bin/python3 "/Users/lavyakumarberiwala/Lab sheet 1/process_management.py"
2. Command Execution
3. Zombie & Orphan Simulation
4. /proc Inspection
5. Process Prioritization

Enter task number (1-5): 3

--- TASK 3: Zombie and Orphan Processes ---

Parent PID=3889 sleeping (not waiting)... Check 'ps -el | grep defunct'
Child (Zombie) exiting immediately...
Parent exiting early, child will become orphan...
● lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 % Orphan child running. New Parent PID=1
/usr/local/bin/python3 "/Users/lavyakumarberiwala/Lab sheet 1/process_management.py"
=== OS LAB EXPERIMENT: PROCESS MANAGEMENT ===
Select a Task to Run:
1. Process Creation
2. Command Execution
3. Zombie & Orphan Simulation
4. /proc Inspection
5. Process Prioritization

Enter task number (1-5): 4

--- TASK 4: Inspecting Process Info from /proc ---

Enter a PID to inspect: 1
Error reading process info: [Errno 2] No such file or directory: '/proc/1/status'
● lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 % /usr/local/bin/python3 "/Users/lavyakumarberiwala/Lab sheet 1/process_management.py"
=== OS LAB EXPERIMENT: PROCESS MANAGEMENT ===
Select a Task to Run:
1. Process Creation
2. Command Execution
3. Zombie & Orphan Simulation
4. /proc Inspection
5. Process Prioritization

Enter task number (1-5): 5

--- TASK 5: Process Prioritization (nice values) ---

Child PID=4170 running with nice value=0
Child PID=4171 running with nice value=5
Child PID=4172 running with nice value=10
Child PID=4170 finished in 0.30s
Child PID=4171 finished in 0.31s
Child PID=4172 finished in 0.31s

All child processes with different priorities have completed.
○ lavyakumarberiwala@Lavyas-MacBook-Air Lab sheet 1 %
```