

# ASSIGNMENT – 1

## OPERATING SYSTEM LAB – WORK

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### Task 1: Process Creation Utility

Write a Python program that creates N child processes using `os.fork()`. Each child prints:

- Its PID
- Its Parent PID
- A custom message

The parent should wait for all children using `os.wait()`.

### CODE:

```
File Actions Edit View Help
GNU nano 8.4 task1_process_creation.py
import os
import time

def main():
    N = int(input("Enter the number of child processes to create: "))
    children_pids = []

    for i in range(N):
        pid = os.fork()
        if pid == 0:
            # Child process
            print(f"Child {i+1}: PID={os.getpid()}, Parent PID={os.getppid()}")
            print(f"Child {i+1}: Hello from child process!")
            time.sleep(1) # Simulate work
            os._exit(0) # Exit child
        else:
            # Parent process
            children_pids.append(pid)

    # Parent waits for all children
    for _ in children_pids:
        finished_pid, status = os.wait()
        print(f"Parent: Child with PID {finished_pid} finished with status {status}")

if __name__ == "__main__":
    main()
```

### OUTPUT

## Task 2:

```
$ python3 task1_process_creation.py
Enter the number of child processes to create: 3
Child 1: PID=12408, Parent PID=12367
Child 1: Hello from child process!
Child 2: PID=12409, Parent PID=12367
Child 2: Hello from child process!
Child 3: PID=12410, Parent PID=12367
Child 3: Hello from child process!
Parent: Child with PID 12408 finished with status 0
Parent: Child with PID 12409 finished with status 0
Parent: Child with PID 12410 finished with status 0
```

### Command Execution Using exec()

Modify Task 1 so that each child process executes a Linux command (ls, date, ps, etc.) using `os.execvp()` or `subprocess.run()`.

### CODE:

```
GNU nano 8.4 task2_command_exec.py
import os

def main():
    commands = ["ls", "date", "whoami"] # Commands children will run
    N = len(commands)
    for i in range(N):
        pid = os.fork()
        if pid == 0:
            print(f"Child {i+1}: PID={os.getpid()}, executing '{commands[i]}'")
            os.execvp(commands[i], [commands[i]]) # Replace child process
            # Parent continues loop
        # Parent waits for all children
    for _ in range(N):
        os.wait()

if __name__ == "__main__":
    main()
```

### OUTPUT

```
$ python3 task2_command_exec.py
Child 1: PID=14587, executing 'ls'
Child 2: PID=14588, executing 'date'
Monday 08 September 2025 03:08:32 PM IST
Child 3: PID=14589, executing 'whoami'
task1_process_creation.py task2_command_exec.py task3_zombie_orphan.py task4_proc_inspection.py task5_priority.py
```

### Zombie & Orphan Processes

**Zombie:** Fork a child and skip `wait()` in the parent.

**Orphan:** Parent exits before the child finishes. Use `ps -el | grep defunct` to identify zombies.

### CODE

### Task 3:

```
File Actions Edit View Help
GNU nano 8.4 task3_zombie_orphan.py
import os
import time

def create_zombie():
    pid = os.fork()
    if pid == 0:
        # Child sleeps briefly and exits
        print(f'Zombie Child: PID={os.getpid()} exiting...')
        os._exit(0)
    else:
        print(f'Parent PID={os.getpid()} not waiting for child {pid}')
        time.sleep(10) # Gives time to check zombie with 'ps -el | grep defunct'

def create_orphan():
    pid = os.fork()
    if pid == 0:
        time.sleep(5)
        print(f'Orphan Child: PID={os.getpid()}, new Parent PID={os.getppid()}')
        os._exit(0)
    else:
        print(f'Parent PID={os.getpid()} exiting immediately')
        os._exit(0)

if __name__ == "__main__":
    print("Creating zombie process...")
    create_zombie()
    time.sleep(2)
    print("\nCreating orphan process...")
    create_orphan()
```

### OUTPUT

```
$ python3 task3_zombie_orphan.py
Creating zombie process ...
Parent PID=18060 not waiting for child 18061
Zombie Child: PID=18061 exiting ...

Creating orphan process ...
Parent PID=18060 exiting immediately
```

```
$ ps -ps -el | grepunct
Orphan Child: PID=18159, new Parent PID=1
```

## Task 4:

### Inspecting Process Info from /proc

Take a PID as input. Read and print:

- Process name, state, memory usage from /proc/[pid]/status
- Executable path from /proc/[pid]/exe
- Open file descriptors from /proc/[pid]/fd

### CODE

```
File Actions Edit View Help
GNU nano 8.4 task4_proc_inspection.py
import os

def main():
    pid = input("Enter PID to inspect: ")
    status_file = f"/proc/{pid}/status"
    exe_file = f"/proc/{pid}/exe"
    fd_folder = f"/proc/{pid}/fd"

    try:
        # Read status
        with open(status_file) as f:
            for line in f:
                if line.startswith(("Name", "State", "VmRSS")):
                    print(line.strip())

        # Executable path
        exe_path = os.readlink(exe_file)
        print(f"Executable Path: {exe_path}")

        # Open file descriptors
        fds = os.listdir(fd_folder)
        print(f"Open File Descriptors: {fds}")

    except FileNotFoundError:
        print(f"No process with PID {pid} exists.")

if __name__ == "__main__":
    main()
```

### OUTPUT

```
$ python3 task4_proc_inspection.py
Enter PID to inspect: 1310
Name:   gvfs-afc-volume
State:  S (sleeping)
VmRSS:   8792 kB
Executable Path: /usr/libexec/gvfs-afc-volume-monitor
Open File Descriptors: ['0', '1', '2', '3', '4', '5', '6', '7']
```

### Process Prioritization

Create multiple CPU-intensive child processes. Assign different nice() values. Observe and log execution order to show scheduler impact.

## Task 5:

### CODE

```
File Actions Edit View Help
GNU nano 8.4 task5_priority.py
import os
import time

def cpu_intensive_task():
    count = 0
    for i in range(10**7):
        count += i
    print(f"Process PID={os.getpid()} finished counting.")

def main():
    nice_values = [0, 5, 10] # Different priorities
    children_pids = []

    for nice_val in nice_values:
        pid = os.fork()
        if pid == 0:
            os.nice(nice_val) # Set process priority
            print(f"Child PID={os.getpid()} with nice={nice_val} starting task ...")
            cpu_intensive_task()
            os._exit(0)
        else:
            children_pids.append(pid)

    # Parent waits
    for _ in children_pids:
        os.wait()

if __name__ == "__main__":
    main()
```

### OUTPUT

```
$ python task5_priority.py
Child PID=27411 with nice=0 starting task ...
Child PID=27412 with nice=5 starting task ...
Child PID=27413 with nice=10 starting task ...
Process PID=27411 finished counting.
Process PID=27412 finished counting.
Process PID=27413 finished counting.
```