106119029 Lab3 Report , Dipesh Kafle

lab4-fork.pdf

Question 1

- Running ps with -A flag will print all the running processes in the system

- Command : `ps -A`

- Output

```
∧ ~/Acads/Sem4/CSLR42-OSLab/Lab3 → ps -A
  PID TTY          TIME CMD
    1 ?        00:00:11 systemd
    2 ?        00:00:00 kthreadd
    3 ?        00:00:00 rcu_gp
    4 ?        00:00:00 rcu_par_gp
    6 ?        00:00:00 kworker/0:0H-kblockd
    8 ?        00:00:00 mm_percpu_wq
    9 ?        00:00:06 ksoftirqd/0
   10 ?        00:00:00 rcuc/0
   11 ?        00:00:30 rcu_preempt
   12 ?        00:00:00 rcub/0
   13 ?        00:00:00 migration/0
   14 ?        00:00:00 idle_inject/0
   16 ?        00:00:00 cpuhp/0
   17 ?        00:00:00 cpuhp/1
   18 ?        00:00:00 idle_inject/1
   19 ?        00:00:00 migration/1
   20 ?        00:00:00 rcuc/1
   21 ?        00:00:04 ksoftirqd/1
   23 ?        00:00:00 kworker/1:0H
   24 ?        00:00:00 cpuhp/2
   25 ?        00:00:00 idle_inject/2
   26 ?        00:00:00 migration/2
   27 ?        00:00:00 rcuc/2
   28 ?        00:00:05 ksoftirqd/2
   30 ?        00:00:00 kworker/2:0H-events_highpri
   31 ?        00:00:00 cpuhp/3
   32 ?        00:00:00 idle_inject/3
   33 ?        00:00:00 migration/3
   34 ?        00:00:00 rcuc/3
   35 ?        00:00:05 ksoftirqd/3
   37 ?        00:00:00 kworker/3:0H-events_highpri
   38 ?        00:00:00 kdevtmpfs
   39 ?        00:00:00 netns
   40 ?        00:00:00 rcu_tasks_kthre
   41 ?        00:00:00 rcu_tasks_rude_
```

```
 349 ?        00:00:00 card1-crtc1
 350 ?        00:00:00 card1-crtc2
 355 ?        00:00:00 systemd-timesyn
 362 ?        00:00:00 avahi-daemon
 363 ?        00:00:00 crond
 364 ?        00:00:29 dbus-daemon
 365 ?        00:00:21 NetworkManager
 367 ?        00:00:00 polkitd
 370 ?        00:00:07 systemd-logind
 371 ?        00:00:06 systemd-machine
 372 ?        00:00:00 avahi-daemon
 429 ?        00:00:01 httpd
 431 ?        00:00:00 sshd
 435 ?        00:00:02 vnstatd
 436 ?        00:00:00 sddm
 461 ?        00:00:00 ttm_swap
 484 ?        00:00:00 bluetoothd
 492 ?        00:00:00 ModemManager
 526 ?        00:00:00 httpd
 527 ?        00:00:00 httpd
 528 ?        00:00:00 httpd
 630 tty1     00:14:11 Xorg
 638 ?        00:00:16 wpa_supplicant
 873 ?        00:00:06 udisksd
 883 ?        00:00:02 upowerd
 914 ?        00:00:00 sddm-helper
 916 ?        00:00:04 systemd
 917 ?        00:00:00 (sd-pam)
 930 ?        00:00:00 kwalletd5
 931 ?        00:00:08 i3
 940 ?        00:00:01 dbus-daemon
 959 ?        00:00:13 nm-applet
 968 ?        00:04:32 picom
 969 ?        00:02:40 polybar
1061 ?        00:57:43 pulseaudio
1133 ?        00:00:00 gvfsd
1146 ?        00:00:00 rtkit-daemon
1158 ?        00:00:00 gvfsd-fuse
1167 ?        00:02:02 kitty
```

```
 1283 pts/1    00:00:00 zsh
 2062 pts/1    00:00:00 tmux: client
 2065 ?        00:00:48 tmux: server
 2775 ?        00:00:22 appimagelaunche
 6674 ?        00:00:00 gvfs-udisks2-vo
 6679 ?        00:00:00 gvfs-gphoto2-vo
 6683 ?        00:00:00 gvfs-mtp-volume
 6687 ?        00:00:00 gvfs-afc-volume
 6692 ?        00:00:00 gvfsd-trash
 6703 ?        00:00:00 gvfsd-network
 6716 ?        00:00:00 gvfsd-dnssd
 6731 ?        00:00:00 dconf-service
12021 ?        00:00:04 kglobalaccel5
12105 ?        00:00:03 kactivitymanage
12113 ?        00:00:00 kdeinit5
12114 ?        00:00:03 klauncher
12142 ?        00:00:03 kded5
18957 pts/2    00:00:05 zsh
30671 ?        00:00:00 kworker/3:1-events
33237 ?        00:00:01 kworker/2:1-events
34791 ?        00:00:01 kworker/u8:19-events_unbound
41761 ?        00:00:00 kworker/2:0-events
42759 ?        00:00:00 irq/127-mei_me
42771 ?        00:00:00 kworker/3:3-events
42773 ?        00:00:00 kworker/u9:2-hci0
45340 ?        00:00:00 kworker/1:7-cgroup_destroy
45344 ?        00:00:19 firefox
45399 ?        00:00:35 Web Content
45461 ?        00:00:14 WebExtensions
45503 ?        00:00:06 Privileged Cont
45576 ?        00:00:05 Web Content
48079 ?        00:00:00 kworker/1:0-events
49494 ?        00:00:01 kworker/0:0-events
51331 ?        00:00:00 kworker/u8:1-events_unbound
52877 ?        00:00:00 kworker/u8:0-events_unbound
52887 ?        00:00:00 kworker/0:2-events
53955 ?        00:00:00 kworker/0:1-events
```

Question 2

- Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>

void print() {
  printf("Process pid: %d, Parent's pid: %d , Process group id : %d\n",
         getpid(), getppid(), getpgrp());
  exit(0);
}
int main() {
  fork();
  fork();
  fork();
  print();
}
```

- Output

3

```
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q2
Process pid: 59949, Parent's pid: 18957 , Process group id : 59949
Process pid: 59951, Parent's pid: 59949 , Process group id : 59949
Process pid: 59952, Parent's pid: 59950 , Process group id : 59949
Process pid: 59950, Parent's pid: 59949 , Process group id : 59949
Process pid: 59954, Parent's pid: 59951 , Process group id : 59949
Process pid: 59955, Parent's pid: 59950 , Process group id : 59949
Process pid: 59953, Parent's pid: 59949 , Process group id : 59949
Process pid: 59956, Parent's pid: 59952 , Process group id : 59949
```

Question 3

- Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>

int main() {
  pid_t pid = fork();
  int status;

  if (pid == 0) {
    // will be executed by child process
    printf("=====================================================\n");
    printf("With execlp\n");
    execlp("ls", "ls", "-l", "-a", NULL);

  } else {
    // code executed by parent process;
    wait(&status);
    printf("Child exited with status %d\n", status);
  }
  if (fork() == 0) {
    printf("=====================================================\n");
    printf("With execl\n");
    execl("/bin/ls", "ls", "-l", "-a", NULL);
  } else {
    wait(&status);
    printf("Child exited with status %d\n", status);
  }
  if (fork() == 0) {
    printf("=====================================================\n");
    printf("With execvp\n");
    char *args[] = {"ls", "-la", NULL};
    execvp("ls", args);
  } else {
    wait(&status);
    printf("Child exited with status %d\n", status);
  }
  if (fork() == 0) {
    printf("=====================================================\n");
    printf("With execv\n");
    char *args[] = {"ls", "-la", NULL};
    execv("/bin/ls", args);
    printf("=====================================================\n");
  } else {
    wait(&status);
    printf("Child exited with status %d\n", status);
  }
}
```

- Output

4

```
Λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q3

With execlp
total 1612
drwxrwxr-x+ 4 dipesh dipesh    4096 Feb 10 20:18 .
drwxrwxr-x+ 5 dipesh dipesh    4096 Feb  9 14:13 ..
-rw-rw-r--  1 dipesh dipesh  397251 Feb  9 14:14 lab4-fork2.pdf
-rw-rw-r--  1 dipesh dipesh   26353 Feb  9 14:14 lab4-fork.pdf
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 20:20 pdf1_out
-rwxrwxr-x+ 1 dipesh dipesh   22496 Feb 10 15:08 pdf1q2
-rw-rw-r--+ 1 dipesh dipesh     280 Feb 10 15:09 pdf1q2.c
-rwxrwxr-x+ 1 dipesh dipesh   23824 Feb 10 17:04 pdf1q3
-rw-rw-r--+ 1 dipesh dipesh    1374 Feb 10 17:04 pdf1q3.c
-rwxrwxr-x+ 1 dipesh dipesh   23440 Feb  9 15:03 pdf1q4
-rw-rw-r--+ 1 dipesh dipesh     786 Feb 10 17:25 pdf1q4.c
-rwxrwxr-x+ 1 dipesh dipesh   22808 Feb 10 16:21 pdf1q5
-rw-rw-r--+ 1 dipesh dipesh     512 Feb 10 16:21 pdf1q5.c
-rwxrwxr-x+ 1 dipesh dipesh   17016 Feb  9 15:27 pdf1q6
-rw-rw-r--+ 1 dipesh dipesh     754 Feb  9 15:27 pdf1q6.c
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 16:53 pt2
-rw-rw-r--+ 1 dipesh dipesh     429 Feb 10 20:18 report.md
-rw-rw-r--+ 1 dipesh dipesh 1064018 Feb 10 20:18 report.pdf
Child exited with status 0

With execl
total 1612
drwxrwxr-x+ 4 dipesh dipesh    4096 Feb 10 20:18 .
drwxrwxr-x+ 5 dipesh dipesh    4096 Feb  9 14:13 ..
-rw-rw-r--  1 dipesh dipesh  397251 Feb  9 14:14 lab4-fork2.pdf
-rw-rw-r--  1 dipesh dipesh   26353 Feb  9 14:14 lab4-fork.pdf
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 20:20 pdf1_out
-rwxrwxr-x+ 1 dipesh dipesh   22496 Feb 10 15:08 pdf1q2
-rw-rw-r--+ 1 dipesh dipesh     280 Feb 10 15:09 pdf1q2.c
-rwxrwxr-x+ 1 dipesh dipesh   23824 Feb 10 17:04 pdf1q3
-rw-rw-r--+ 1 dipesh dipesh    1374 Feb 10 17:04 pdf1q3.c
-rwxrwxr-x+ 1 dipesh dipesh   23440 Feb  9 15:03 pdf1q4
-rw-rw-r--+ 1 dipesh dipesh     786 Feb 10 17:25 pdf1q4.c
-rwxrwxr-x+ 1 dipesh dipesh   22808 Feb 10 16:21 pdf1q5
-rw-rw-r--+ 1 dipesh dipesh     512 Feb 10 16:21 pdf1q5.c
-rwxrwxr-x+ 1 dipesh dipesh   17016 Feb  9 15:27 pdf1q6
-rw-rw-r--+ 1 dipesh dipesh     754 Feb  9 15:27 pdf1q6.c
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 16:53 pt2
-rw-rw-r--+ 1 dipesh dipesh     429 Feb 10 20:18 report.md
-rw-rw-r--+ 1 dipesh dipesh 1064018 Feb 10 20:18 report.pdf
Child exited with status 0
```

```
With execvp
total 1612
drwxrwxr-x+ 4 dipesh dipesh    4096 Feb 10 20:18 .
drwxrwxr-x+ 5 dipesh dipesh    4096 Feb  9 14:13 ..
-rw-rw-r--  1 dipesh dipesh  397251 Feb  9 14:14 lab4-fork2.pdf
-rw-rw-r--  1 dipesh dipesh   26353 Feb  9 14:14 lab4-fork.pdf
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 20:20 pdf1_out
-rwxrwxr-x+ 1 dipesh dipesh   22496 Feb 10 15:08 pdf1q2
-rw-rw-r--+ 1 dipesh dipesh     280 Feb 10 15:09 pdf1q2.c
-rwxrwxr-x+ 1 dipesh dipesh   23824 Feb 10 17:04 pdf1q3
-rw-rw-r--+ 1 dipesh dipesh    1374 Feb 10 17:04 pdf1q3.c
-rwxrwxr-x+ 1 dipesh dipesh   23440 Feb  9 15:03 pdf1q4
-rw-rw-r--+ 1 dipesh dipesh     786 Feb 10 17:25 pdf1q4.c
-rwxrwxr-x+ 1 dipesh dipesh   22808 Feb 10 16:21 pdf1q5
-rw-rw-r--+ 1 dipesh dipesh     512 Feb 10 16:21 pdf1q5.c
-rwxrwxr-x+ 1 dipesh dipesh   17016 Feb  9 15:27 pdf1q6
-rw-rw-r--+ 1 dipesh dipesh     754 Feb  9 15:27 pdf1q6.c
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 16:53 pt2
-rw-rw-r--+ 1 dipesh dipesh     429 Feb 10 20:18 report.md
-rw-rw-r--+ 1 dipesh dipesh 1064018 Feb 10 20:18 report.pdf
Child exited with status 0

With execv
total 1612
drwxrwxr-x+ 4 dipesh dipesh    4096 Feb 10 20:18 .
drwxrwxr-x+ 5 dipesh dipesh    4096 Feb  9 14:13 ..
-rw-rw-r--  1 dipesh dipesh  397251 Feb  9 14:14 lab4-fork2.pdf
-rw-rw-r--  1 dipesh dipesh   26353 Feb  9 14:14 lab4-fork.pdf
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 20:20 pdf1_out
-rwxrwxr-x+ 1 dipesh dipesh   22496 Feb 10 15:08 pdf1q2
-rw-rw-r--+ 1 dipesh dipesh     280 Feb 10 15:09 pdf1q2.c
-rwxrwxr-x+ 1 dipesh dipesh   23824 Feb 10 17:04 pdf1q3
-rw-rw-r--+ 1 dipesh dipesh    1374 Feb 10 17:04 pdf1q3.c
-rwxrwxr-x+ 1 dipesh dipesh   23440 Feb  9 15:03 pdf1q4
-rw-rw-r--+ 1 dipesh dipesh     786 Feb 10 17:25 pdf1q4.c
-rwxrwxr-x+ 1 dipesh dipesh   22808 Feb 10 16:21 pdf1q5
-rw-rw-r--+ 1 dipesh dipesh     512 Feb 10 16:21 pdf1q5.c
-rwxrwxr-x+ 1 dipesh dipesh   17016 Feb  9 15:27 pdf1q6
-rw-rw-r--+ 1 dipesh dipesh     754 Feb  9 15:27 pdf1q6.c
drwxrwxr-x+ 2 dipesh dipesh    4096 Feb 10 16:53 pt2
-rw-rw-r--+ 1 dipesh dipesh     429 Feb 10 20:18 report.md
-rw-rw-r--+ 1 dipesh dipesh 1064018 Feb 10 20:18 report.pdf
Child exited with status 0
```

Question 4

- Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>
void print_all_primes(int n) {
  printf("From pid %d, Printing all the primes till %d\n", getpid(), n);
  if (n < 0) {
    printf("Invalid number %d\n", n);
    exit(1);
  }
  int isPrime = 1;
  for (int i = 2; i < n; i++) {
    isPrime = 1;
    for (int j = 2; j < i; j++) {
      if (i % j == 0) {
        isPrime = 0;
        break;
      }
    }
    if (isPrime)
      printf("%d\n", i);
  }
  exit(0);
}
int main(int argc, char *argv[]) {
  int status;
  if (fork() == 0) {
    if (argc <= 1) {
      printf("No argument provided to the program\n");
      exit(1);
    }
    print_all_primes(atoi(argv[1]));
  } else {
    wait(&status);
    printf("Child process exited with %d\n", status);
  }
}
```

- Output

```
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 → ./pdf1q4
No argument provided to the program
Child process exited with 256
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 → ./pdf1q4 -20
From pid 61558, Printing all the primes till -20
Invalid number -20
Child process exited with 256
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 → ./pdf1q4 50
From pid 61566, Printing all the primes till 50
2
3
5
7
11
13
17
19
23
29
31
37
41
43
47
Child process exited with 0
```

Question 5

- Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>

int main(int argc, char *argv[]) {
  if (fork() == 0) {
    if (argc == 2) {
      printf("Executing from child process:\n");
      execl("/bin/ls", "ls", argv[1], NULL);
    } else if (argc == 1) {
      printf("Didnt receive directory name as argument\n");
      exit(1);
    } else {
      printf("To many arguments received. Expected only 1\n");
      exit(1);
    }
  } else {
    wait(NULL);
    printf("\nDone..\n");
  }
}
```

- Output

```
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q5
Didnt receive directory name as argument

Done..
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q5 a b
To many arguments received. Expected only 1

Done..
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q5 a
Executing from child process:
ls: cannot access 'a': No such file or directory

Done..
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q5 .
Executing from child process:
lab4-fork2.pdf   pdf1q2     pdf1q3.c   pdf1q5      pdf1q6.c     report.pdf
lab4-fork.pdf    pdf1q2.c   pdf1q4     pdf1q5.c    pt2
pdf1_out         pdf1q3     pdf1q4.c   pdf1q6      report.md

Done..
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q5 ..
Executing from child process:
CSLR42_OSlab_Courseplan.pdf  Lab1   Lab2   Lab3

Done..
```

Question 6

- Code

```c
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>

void *print_all_odds(void *param) {
  int n = *((int *)param);
  for (int i = 1; i <= n; i += 2) {
    printf("Odd: %d\n", i);
  }
  return NULL;
}
void *print_all_evens(void *param) {
  int n = *((int *)param);
  for (int i = 2; i <= n; i += 2) {
    printf("Even: %d\n", i);
  }
  return NULL;
}

int main(int argc, char *argv[]) {
  if (argc != 2) {
    printf("Wrong number of arguments received\n");
    exit(1);
  }
  int n = atoi(argv[1]);
  pthread_t thread1, thread2;
  pthread_create(&thread1, NULL, print_all_odds, &n);
  pthread_create(&thread2, NULL, print_all_evens, &n);
  pthread_join(thread1, NULL);
  pthread_join(thread2, NULL);
}
```

- Output

```
30 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →   ./pdf1q6
29 Wrong number of arguments received
28 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →   ./pdf1q6 1 2
27 Wrong number of arguments received
26 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →   ./pdf1q6 1
25 Odd: 1
24 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →   ./pdf1q6 2
23 Odd: 1
22 Even: 2
21 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →   ./pdf1q6 20
20 Odd: 1
19 Odd: 3
18 Odd: 5
17 Odd: 7
16 Odd: 9
15 Odd: 11
14 Odd: 13
13 Odd: 15
12 Odd: 17
11 Odd: 19
10 Even: 2
 9 Even: 4
 8 Even: 6
 7 Even: 8
 6 Even: 10
 5 Even: 12
 4 Even: 14
 3 Even: 16
 2 Even: 18
 1 Even: 20
```

```
21 λ ~/Acads/Sem4/CSLR42-OSLab/Lab3 →  ./pdf1q6 20
20 Odd: 1
19 Odd: 3
18 Odd: 5
17 Even: 2
16 Even: 4
15 Even: 6
14 Even: 8
13 Even: 10
12 Even: 12
11 Even: 14
10 Even: 16
 9 Even: 18
 8 Even: 20
 7 Odd: 7
 6 Odd: 9
 5 Odd: 11
 4 Odd: 13
 3 Odd: 15
 2 Odd: 17
 1 Odd: 19
```

lab4-fork2.pdf

- Code

```c
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>
void function(int linetoprint) {
  FILE *fp = fopen("file2.txt", "r");
  char buf[1000];
  int lineno = 0;
  while (fgets(buf, sizeof(buf), fp) != NULL) {
    if (lineno == linetoprint)
      break;
    lineno++;
  }
  if (lineno == linetoprint) {
    printf("Line no %d: %s\n", linetoprint, buf);
  } else {
    printf("File doesnt have %d lines\n", linetoprint);
  }
}
int main() {
  pid_t pids[4];
  for (int i = 0; i < 4; i++) {
    pids[i] = fork();
    if (pids[i] < 0) {
      printf("Failed to fork\n");
      exit(1);
    } else if (pids[i] == 0) {
      function(i); // child wont ever do anything except run function(i)
      // there will be no forking from child process
      exit(0);
    } else {
      continue;
    }
  }
  for (int i = 0; i < 4; i++)
    wait(NULL);
}
```

- Output

```
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3/pt2 →  cat file2.txt
Child1 reads this line
Child2 reads this line
Child3 reads this line
Child4 reads this line
λ ~/Acads/Sem4/CSLR42-OSLab/Lab3/pt2 →  ./file1
Line no 0: Child1 reads this line

Line no 1: Child2 reads this line

Line no 2: Child3 reads this line

Line no 3: Child4 reads this line
```

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