Operating Systems Homework #01 Part B

Berru Lafcı - 1901042681

I just did the first and second strategy in this part. So, there is no priority scheduling.

The rest of the code is the same except kernel.cpp.

I generated random numbers with the clock counter. It uses the rdtsc assembly instruction to read the time-stamp counter, which provides a high-resolution timer value. The counter value is then manipulated with a linear congruential generator algorithm to produce a random number. The resulting value is adjusted to fall within the specified range and returned.

```
common::int32_t generateRandomNumber(int min, int max)
{
    uint64_t counter;
    int32_t num;

    // Get the clock counter
    asm volatile("rdtsc" : "=A"(counter));

    // Generate a random number using the clock counter
    counter = counter * 1103515245 + 12345;
    num = (int32_t)((counter >> 16) & 0x7FFFFFFF) % (max - min);

    if (num < 0)
        num += max;

    return num + min;
}
```

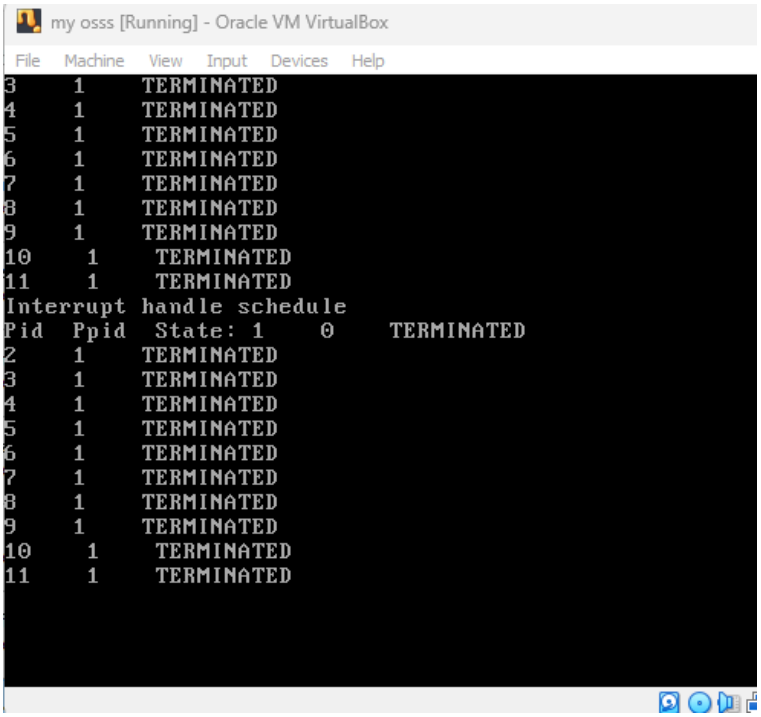
First Strategy: Waitpid(i+2) because my parent process starts with pid 1.

```
void FirstStrategy() {

    // First strategy: Randomly select a task and run it 10 times
    common::uint32_t pid1 = 0;
    int parentpid = getpid();
    int loop_time = 10;

    int randomNumber = generateRandomNumber(1,4);

    printf("Random Number: ");
    printInt(randomNumber);
    printf("\n");

    for(int i=0; i < loop_time; i++){

        // printf("Loop: ");
        // printInt(i+1);
        // printf("\n");

        switch (randomNumber)
        {
            case 1:
                pid1 = fork(parentpid);
                if(pid1 == 0){
                    taskCollatz();
                    exitt();
                }
                break;
            case 2:
                pid1 = fork(parentpid);
                if(pid1 == 0){
                    taskBinarySearch();
                    exitt();
                }
                break;
            case 3:
                pid1 = fork(parentpid);
                if(pid1 == 0){
                    taskLinearSearch();
                    exitt();
                }
                break;
            case 4:
                pid1 = fork(parentpid);
                if(pid1 == 0){
```

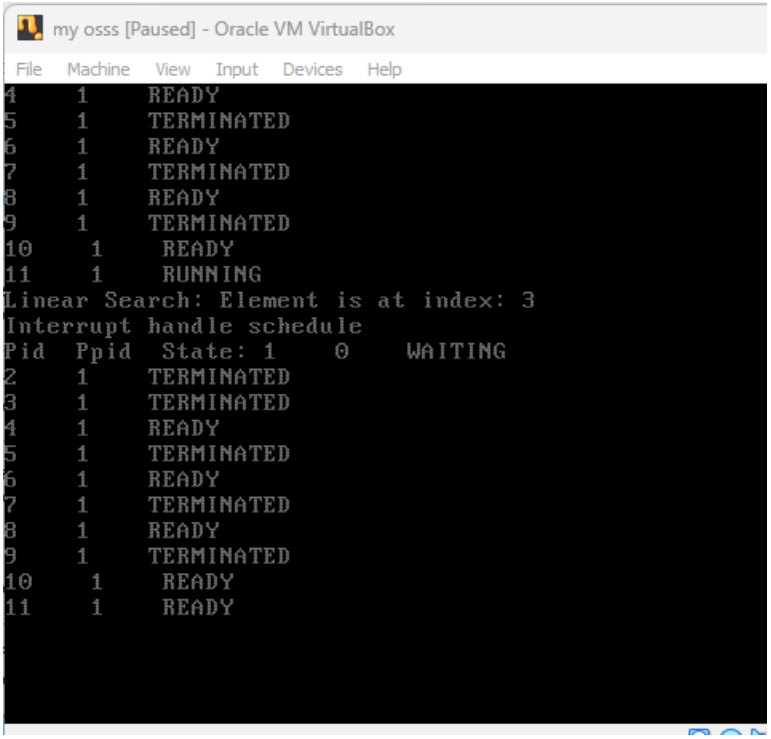
```
            case 4:
                pid1 = fork(parentpid);
                if(pid1 == 0){
                    common::uint32_t res;
                    res = long_running_program(1000);
                    printInt(res);
                    exitt();
                }
                break;
            default:
                break;
        }
    }

    // The parent process waits for all child processes to complete
    for (int i = 0; i < loop_time; i++) {
        waitpidd(i+2);
        //printf("\n");
    }

    exitt();
}
```

Outputs:

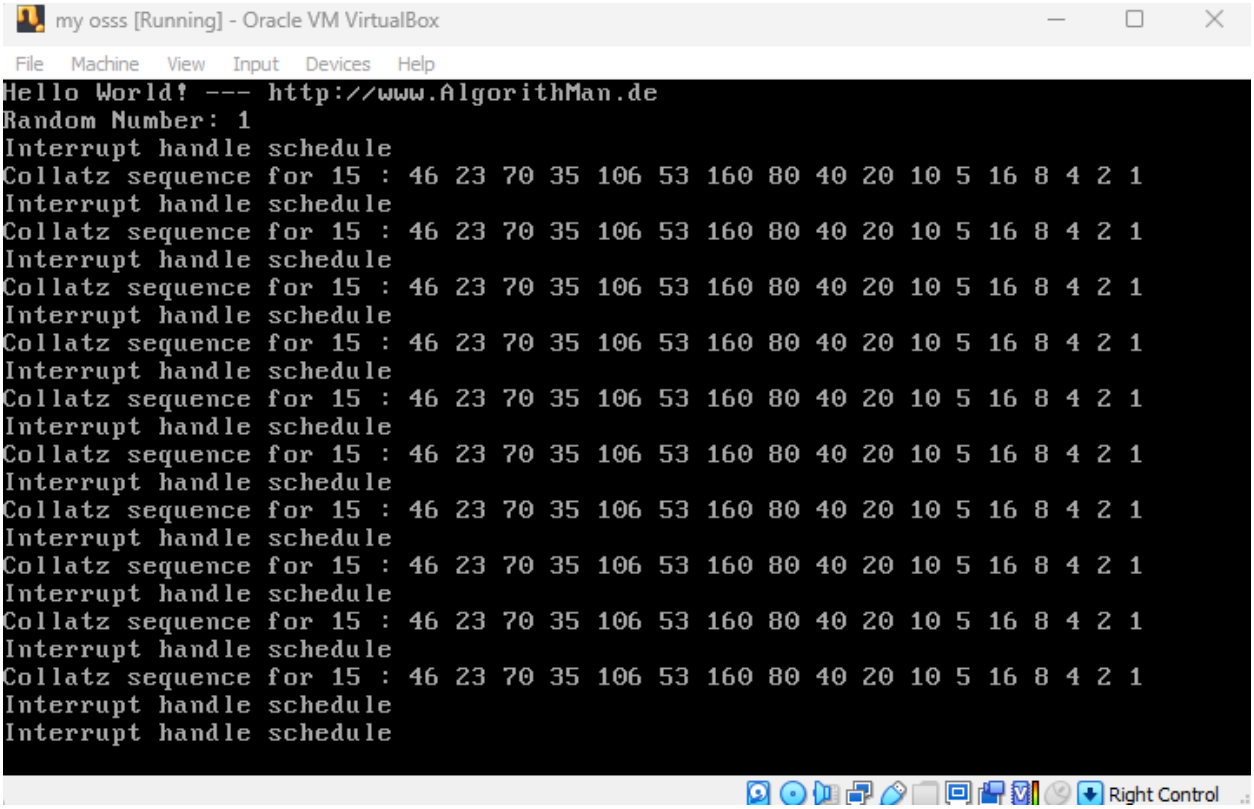
With process table:



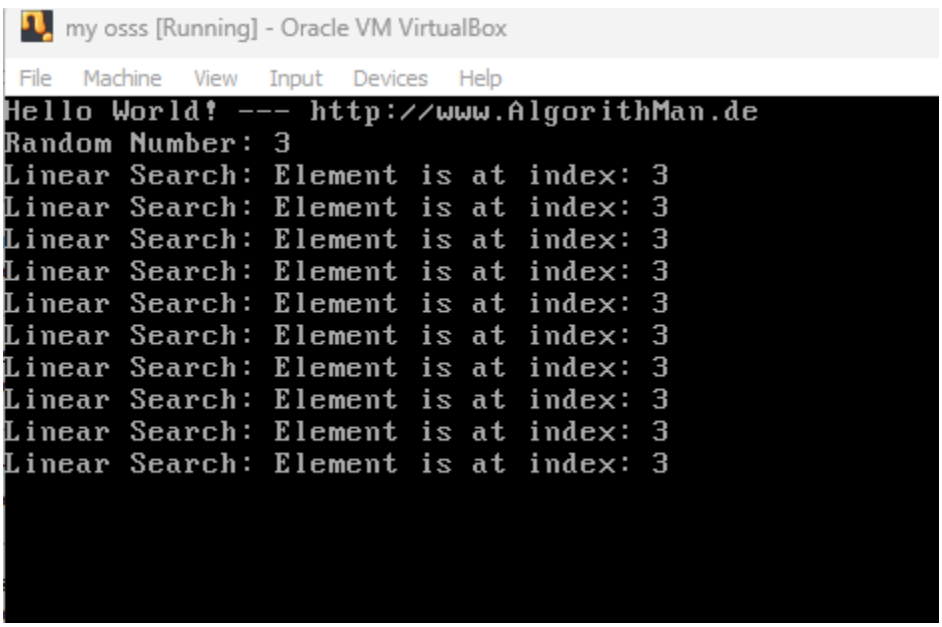
During the execution:



Without process table:



```
Hello World! --- http://www.AlgorithMan.de
Random Number: 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Interrupt handle schedule
```



```
Hello World! --- http://www.AlgorithMan.de
Random Number: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
Linear Search: Element is at index: 3
```

Second Strategy: There are 2 for loops to run 2 different task.

```
void SecondStrategy() {

    // Second strategy: Choosing 2 out 4 programs randomly and loading each program 3 times
    int randomNumber1 = generateRandomNumber(1,4);
    int randomNumber2 = generateRandomNumber(1,4);

    while(randomNumber1==randomNumber2){
        randomNumber2 = generateRandomNumber(1,4); // Make sure that the two random numbers are different
    }

    common::uint32_t pid2=0;
    common::uint32_t pid3=0;

    int parentpid = getpid();

    printf("Random Number: ");
    printInt(randomNumber1);
    printf(" ");
    printInt(randomNumber2);
    printf("\n");

    for(int i = 0; i < 3; i++){
        switch (randomNumber1)
        {
            case 1:
                pid2 = fork(parentpid);
                if(pid2 == 0){
                    taskCollatz();
                    exitt();
                }
                break;
            case 2:
                pid2 = fork(parentpid);
                if(pid2 == 0){
                    taskBinarySearch();
                    exitt();
                }
                break;
            case 3:
                pid2 = fork(parentpid);
                if(pid2 == 0){
                    taskLinearSearch();
                    exitt();
                }
                break;
```

```
                break;
            case 3:
                pid2 = fork(parentpid);
                if(pid2 == 0){
                    taskLinearSearch();
                    exitt();
                }
                break;
            case 4:
                pid2 = fork(parentpid);
                if(pid2 == 0){
                    common::uint32_t res;
                    res = long_running_program(1000);
                    printInt(res);
                    exitt();
                }
                break;
            default:
                break;
        }
    }

    for(int i = 0; i < 3; i++){
        switch (randomNumber2)
        {
            case 1:
                pid3 = fork(parentpid);
                if(pid3 == 0){
                    taskCollatz();
                    exitt();
                }
                break;
            case 2:
                pid3 = fork(parentpid);
                if(pid3 == 0){
                    taskBinarySearch();
                    exitt();
                }
                break;
            case 3:
                pid3 = fork(parentpid);
                if(pid3 == 0){
                    taskLinearSearch();
                    exitt();
                }
```

```
                }
                break;
            case 3:
                pid3 = fork(parentpid);
                if(pid3 == 0){
                    taskLinearSearch();
                    exitt();
                }
                break;
            case 4:
                pid3 = fork(parentpid);
                if(pid3 == 0){
                    common::uint32_t res;
                    res = long_running_program(1000);
                    printInt(res);
                    exitt();
                }
                break;
            default:
                break;
        }
    }

    // The parent process waits for all child processes to complete
    for (int i = 0; i < 6; i++) {
        waitpidd(i+2);
        //printf("\n");
    }

    exitt();
}
```

Outputs: You can observe the round robin scheduling with timer interrupt from the different orders of processes.

my osss [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
Hello World! --- http://www.AlgorithMan.de
Random Number: 1 2
Interrupt handle schedule
Binary Search: Element is at index 4
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Binary Search: Element is at index 4
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Binary Search: Element is at index 4
Interrupt handle schedule
Interrupt handle schedule
```

my osss [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
Hello World! --- http://www.AlgorithMan.de
Random Number: 1 3
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Linear Search: Element is at index: 3
Interrupt handle schedule
Interrupt handle schedule
Linear Search: Element is at index: 3
Interrupt handle schedule
Collatz sequence for 15 : 46 23 70 35 106 53 160 80 40 20 10 5 16 8 4 2 1
Interrupt handle schedule
Interrupt handle schedule
Linear Search: Element is at index: 3
Interrupt handle schedule
Interrupt handle schedule
```