가산점 반영하지 않음	20212211 권대호

실행 전 입력해야하는 명령어 (프로세서 수가 8개인 경우)

```
chcpu -d 1
chcpu -d 2
chcpu -d 3
chcpu -d 4
chcpu -d 5
chcpu -d 6
chcpu -d 7
```

1. 소스코드

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/wait.h>
#include <sched.h>
#include <time.h>
#include <string.h>
#include <sys/syscall.h>
#include <sys/time.h>
#include <sys/mman.h>
#include <fcntl.h>

struct sched_attr {
    int size;
    int sched_policy;
    unsigned long long sched_runtime;
    unsigned long long sched_deadline;
    unsigned long long sched_period;
    int sched_flags;
    int sched_nice;
    int sched_priority;
};

static int sched_setattr(pid_t pid, const struct sched_attr *attr, unsigned int flags) {
    return syscall(SYS_sched_setattr, pid, attr, flags);
}

int main() {
    printf("₩033[H₩033[J");
    struct timeval mytime;
    double startTime[21], endTime[21];
    double startTimeMil[21], endTimeMil[21];
    double *averages;
    long pidList[21];
    int sp = 0;
    int resulty;
    struct sched_attr attr;
    int cycle = 21;
    int niceValue[21];
    int timeSlice = 10000;
    srand((unsigned)time(NULL));

    printf("Input the Scheduling Policy to apply:₩n");
    printf("1. CFS_Default₩n");
```

```
    printf("2. CFS_NICE₩n");
    printf("3. RT_FIFO₩n");
    printf("4. RT_RR₩n");

    while (sp != 1 && sp != 2 && sp != 3 && sp != 4) {
        scanf("%d", &sp);
    }
    if (sp == 4) {
        printf("Input Time Slice to apply: ₩n");
        printf("1. 10ms₩n");
        printf("2. 100ms₩n");
        printf("3. 1000ms₩n");
        while (timeSlice != 1 && timeSlice != 2 && timeSlice != 3) {
            scanf("%d", &timeSlice);
        }
    }
    pid_t pidMaster = getpid();

    // averages for calculate average of Elapsed Time
    averages = (double *)mmap(NULL, cycle * sizeof(double), PROT_READ | PROT_WRITE, MAP_SHARED | MAP_ANONYMOUS,
-1, 0);
    if (averages == MAP_FAILED) {
        perror("mmap failed");
        exit(1);
    }

    for (int at = 1; at <= cycle; at++) {
        pid_t pid = fork();

        if (pid < 0) {
            perror("Fork failed");
            exit(1);
        } else if (pid == 0) {
            //startTime Calc
            gettimeofday(&mytime, NULL);
            startTime[at - 1] = (mytime.tv_sec + 9 * 60 * 60) % (60 * 60 * 24);
            startTimeMil[at - 1] = mytime.tv_usec;
            pidList[at - 1] = pidMaster + getpid();
            memset(&attr, 0, sizeof(attr));
            attr.size = sizeof(struct sched_attr);

            if (sp == 1) {
                attr.sched_policy = SCHED_OTHER;
                attr.sched_nice = 0;
            } else if (sp == 2) {
                attr.sched_policy = SCHED_OTHER;
            } else if (sp == 3) {
                attr.sched_policy = SCHED_FIFO;
                attr.sched_priority = 95;
            } else if (sp == 4) {
                attr.sched_policy = SCHED_RR;
                attr.sched_priority = 95;
                if (timeSlice == 1) {
                    attr.sched_period = 10;
                } else if (timeSlice == 2) {
                    attr.sched_period = 100;
                } else {
                    attr.sched_period = 1000;
```

```
        }
    }
    if (sp == 2) {
        if (at / 8 == 0) {
            attr.sched_nice = -20;
            niceValue[at - 1] = -20;
        } else if (at / 8 == 1) {
            attr.sched_nice = 0;
            niceValue[at - 1] = 0;
        } else if (at / 8 == 2) {
            attr.sched_nice = 19;
            niceValue[at - 1] = 19;
        }
    }

    resulty = sched_setattr(getpid(), &attr, 0);

    int B[100][100];
    int A[100][100];

    for (int k = 0; k < 100; k++) {
        for (int j = 0; j < 100; j++) {
            A[j][k] = rand();
            B[j][k] = rand();
        }
    }

    int count = 0;
    int result[100][100] = {0};

    while (count < 100) {
        for (int k = 0; k < 100; k++) {
            for (int i = 0; i < 100; i++) {
                for (int j = 0; j < 100; j++) {
                    result[k][j] += A[k][j] * B[i][j];
                }
            }
        }
        count++;
    }
    //endTime Calc
    gettimeofday(&mytime, NULL);
    endTime[at - 1] = (mytime.tv_sec + 9 * 60 * 60) % (60 * 60 * 24);
    endTimeMil[at - 1] = mytime.tv_usec;

    //print Information
    int check = at - 1;
    long temp1 = startTime[check] / (60 * 60);
    long temp2 = startTime[check] / 60 - temp1 * 60;
    long temp3 = startTime[check] - temp2 * 60 - temp1 * 60 * 60;
    printf("PID: %ld | ", pidList[check]);
    if (sp == 2) {
        printf("NICE: %d | ", niceValue[check]);
    }
    printf("Start time: %ld:%ld:%ld.%lf | ", temp1, temp2, temp3, startTimeMil[check]);
    long temp4 = endTime[check] / (60 * 60);
    long temp5 = endTime[check] / 60 - temp1 * 60;
    long temp6 = endTime[check] - temp2 * 60 - temp1 * 60 * 60;
```

```
            printf("End time: %ld:%ld:%ld.%.lf | ", temp4, temp5, temp6, endTimeMil[check]);
            long temp7 = temp4 - temp1;
            long temp8 = temp5 - temp2;
            long temp9 = temp6 - temp3;
            double revised = endTimeMil[check] - startTimeMil[check];
            if (revised < 0) {
                revised = 1000000 + revised;
                temp9 -= 1;
            }
            printf("Elapsed time: %ld:%ld:%ld.%.lf | ₩n", temp7, temp8, temp9, revised);

            //Send Process Elapsed time to parent Process
            double temp10 = (endTime[check] - startTime[check]) / (60 * 60);
            double temp100 = (endTime[check] - startTime[check]) / 60 - temp10 * 60;
                                    double temp1000 = (endTime[check] - startTime[check]) - temp100 * 60 - temp10 * 60 *
60;
            double tempMil = endTimeMil[check] - startTimeMil[check];
            double elapsed = (temp10 * 60 * 60 + temp100 * 60 + temp1000) * 1000000 + tempMil;
            averages[check] = elapsed;

            exit(0);
        }
    }

    // Wait for every process to terminate
    for (int i = 0; i < 21; i++) {
        wait(NULL);
    }

    // Calculate Average of process Elapsed time
    double totalAverage = 0;
    for (int i = 0; i < cycle; i++) {
        totalAverage += averages[i];
    }

    totalAverage /= cycle;
    double tvSec = totalAverage / 1000000;
    double tvUsec = totalAverage - tvSec * 1000000;
    double hour = tvSec / (60 * 60);
    double min = tvSec / 60 - hour * 60;
    double sec = tvSec - hour * 60 * 60 - min * 60;
   //print SchedPolicy & Average Time & timeQuantum
    char spChar[20];
            if (sp == 1) {
                    strcpy(spChar, "CFS_DEFAULT");
            } else if (sp == 2) {
                    strcpy(spChar, "CFS_NICE");
            } else if (sp == 3) {
                    strcpy(spChar, "RT_FIFO");
            } else {
                    strcpy(spChar, "RT_RR");
            }

    printf("Scheduling Policy: %s | ", spChar);
    if(sp == 4){
                if(timeSlice == 1){
                        timeSlice = 10;
                } else if(timeSlice == 2){
```

```
                        timeSlice = 100;
                } else {
                        timeSlice = 1000;
                }
                printf("Time Quantum: %d ms | ", timeSlice);
        }
        printf("Average Elapsed Time::%lf₩n", tvSec);
        munmap(averages, cycle * sizeof(double));
        return 0;
}
```

2. 실행결과

가. CFS_DEFAULT를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
1
PID: 29648 | Start time: 23:55:36.768902 | End time: 23:55:47.223334 | Elapsed time: 0:0:10.454432 |
PID: 29636 | Start time: 23:55:36.540728 | End time: 23:55:47.416705 | Elapsed time: 0:0:10.875977 |
PID: 29641 | Start time: 23:55:36.636682 | End time: 23:55:47.486448 | Elapsed time: 0:0:10.849766 |
PID: 29651 | Start time: 23:55:36.814018 | End time: 23:55:47.519296 | Elapsed time: 0:0:10.705278 |
PID: 29647 | Start time: 23:55:36.753899 | End time: 23:55:47.539435 | Elapsed time: 0:0:10.785536 |
PID: 29650 | Start time: 23:55:36.798905 | End time: 23:55:47.707289 | Elapsed time: 0:0:10.908384 |
PID: 29642 | Start time: 23:55:36.648903 | End time: 23:55:47.547285 | Elapsed time: 0:0:10.898382 |
PID: 29637 | Start time: 23:55:36.543880 | End time: 23:55:47.554818 | Elapsed time: 0:0:11.10938 |
PID: 29654 | Start time: 23:55:36.870951 | End time: 23:55:47.573312 | Elapsed time: 0:0:10.702361 |
PID: 29645 | Start time: 23:55:36.693884 | End time: 23:55:47.601851 | Elapsed time: 0:0:10.907967 |
PID: 29639 | Start time: 23:55:36.603971 | End time: 23:55:47.627796 | Elapsed time: 0:0:11.23825 |
PID: 29653 | Start time: 23:55:36.843426 | End time: 23:55:47.735170 | Elapsed time: 0:0:10.891744 |
PID: 29643 | Start time: 23:55:36.662384 | End time: 23:55:47.635018 | Elapsed time: 0:0:10.972634 |
PID: 29655 | Start time: 23:55:36.873424 | End time: 23:55:47.651015 | Elapsed time: 0:0:10.777591 |
PID: 29646 | Start time: 23:55:36.723913 | End time: 23:55:47.661245 | Elapsed time: 0:0:10.937332 |
PID: 29640 | Start time: 23:55:36.633918 | End time: 23:55:47.710136 | Elapsed time: 0:0:11.76218 |
PID: 29649 | Start time: 23:55:36.774918 | End time: 23:55:47.714031 | Elapsed time: 0:0:10.939113 |
PID: 29638 | Start time: 23:55:36.572714 | End time: 23:55:47.734478 | Elapsed time: 0:0:11.161764 |
PID: 29644 | Start time: 23:55:36.663885 | End time: 23:55:47.561653 | Elapsed time: 0:0:10.897768 |
PID: 29652 | Start time: 23:55:36.838953 | End time: 23:55:47.738271 | Elapsed time: 0:0:10.899318 |
PID: 29635 | Start time: 23:55:36.525107 | End time: 23:55:47.767206 | Elapsed time: 0:0:11.242099 |
Scheduling Policy: CFS_DEFAULT | Average Elapsed Time::10.900877
root@ubuntu:/home/id20212211/Desktop#
```

나. CFS_NICE를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
2
PID: 29702 | NICE: 19 | Start time: 23:59:16.832265 | End time: 23:59:27.77442 | Elapsed time: 0:0:10.245177 |
PID: 29695 | NICE: 0 | Start time: 23:59:16.715727 | End time: 23:59:27.503185 | Elapsed time: 0:0:10.787458 |
PID: 29687 | NICE: -20 | Start time: 23:59:16.553537 | End time: 23:59:27.107880 | Elapsed time: 0:0:10.554343 |
PID: 29694 | NICE: 0 | Start time: 23:59:16.689206 | End time: 23:59:27.166099 | Elapsed time: 0:0:10.476893 |
PID: 29692 | NICE: 0 | Start time: 23:59:16.655732 | End time: 23:59:27.200278 | Elapsed time: 0:0:10.544546 |
PID: 29703 | NICE: 19 | Start time: 23:59:16.843269 | End time: 23:59:27.298835 | Elapsed time: 0:0:10.455566 |
PID: 29685 | NICE: -20 | Start time: 23:59:16.551471 | End time: 23:59:27.311725 | Elapsed time: 0:0:10.760254 |
PID: 29688 | NICE: -20 | Start time: 23:59:16.567454 | End time: 23:59:27.358248 | Elapsed time: 0:0:10.790794 |
PID: 29701 | NICE: 19 | Start time: 23:59:16.805764 | End time: 23:59:27.405447 | Elapsed time: 0:0:10.599683 |
PID: 29686 | NICE: -20 | Start time: 23:59:16.553116 | End time: 23:59:27.432176 | Elapsed time: 0:0:10.879060 |
PID: 29690 | NICE: 0 | Start time: 23:59:16.625731 | End time: 23:59:27.460920 | Elapsed time: 0:0:10.835189 |
PID: 29697 | NICE: 0 | Start time: 23:59:16.745728 | End time: 23:59:27.473519 | Elapsed time: 0:0:10.727791 |
PID: 29684 | NICE: -20 | Start time: 23:59:16.523503 | End time: 23:59:27.478017 | Elapsed time: 0:0:10.954514 |
PID: 29691 | NICE: 0 | Start time: 23:59:16.627873 | End time: 23:59:27.489252 | Elapsed time: 0:0:10.861379 |
PID: 29698 | NICE: 19 | Start time: 23:59:16.752241 | End time: 23:59:27.512727 | Elapsed time: 0:0:10.760486 |
PID: 29689 | NICE: -20 | Start time: 23:59:16.595791 | End time: 23:59:27.514563 | Elapsed time: 0:0:10.918772 |
PID: 29693 | NICE: 0 | Start time: 23:59:16.685720 | End time: 23:59:27.514615 | Elapsed time: 0:0:10.828895 |
PID: 29700 | NICE: 19 | Start time: 23:59:16.800258 | End time: 23:59:27.517297 | Elapsed time: 0:0:10.717039 |
PID: 29683 | NICE: -20 | Start time: 23:59:16.489386 | End time: 23:59:27.518716 | Elapsed time: 0:0:11.29330 |
PID: 29696 | NICE: 0 | Start time: 23:59:16.720230 | End time: 23:59:27.527126 | Elapsed time: 0:0:10.806896 |
PID: 29699 | NICE: 19 | Start time: 23:59:16.775739 | End time: 23:59:27.582477 | Elapsed time: 0:0:10.806738 |
Scheduling Policy: CFS_NICE | Average Elapsed Time::10.730514
root@ubuntu:/home/id20212211/Desktop#
```

다. RT_FIFO를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
3
PID: 29791 | Start time: 0:0:34.218385 | End time: 0:0:44.929656 | Elapsed time: 0:0:10.711271 |
PID: 29805 | Start time: 0:0:34.421046 | End time: 0:0:45.14279 | Elapsed time: 0:0:10.593233 |
PID: 29798 | Start time: 0:0:34.282471 | End time: 0:0:45.368995 | Elapsed time: 0:0:11.86524 |
PID: 29795 | Start time: 0:0:34.265165 | End time: 0:0:45.64404 | Elapsed time: 0:0:10.799239 |
PID: 29803 | Start time: 0:0:34.399347 | End time: 0:0:45.92335 | Elapsed time: 0:0:10.692988 |
PID: 29792 | Start time: 0:0:34.236538 | End time: 0:0:45.130419 | Elapsed time: 0:0:10.893881 |
PID: 29799 | Start time: 0:0:34.308988 | End time: 0:0:45.164033 | Elapsed time: 0:0:10.855045 |
PID: 29802 | Start time: 0:0:34.371843 | End time: 0:0:45.219467 | Elapsed time: 0:0:10.847624 |
PID: 29804 | Start time: 0:0:34.416933 | End time: 0:0:45.242437 | Elapsed time: 0:0:10.825504 |
PID: 29811 | Start time: 0:0:34.540370 | End time: 0:0:45.250556 | Elapsed time: 0:0:10.710186 |
PID: 29797 | Start time: 0:0:34.281497 | End time: 0:0:45.373924 | Elapsed time: 0:0:11.92427 |
PID: 29801 | Start time: 0:0:34.341016 | End time: 0:0:45.270190 | Elapsed time: 0:0:10.929174 |
PID: 29800 | Start time: 0:0:34.311835 | End time: 0:0:45.289564 | Elapsed time: 0:0:10.977729 |
PID: 29808 | Start time: 0:0:34.506878 | End time: 0:0:45.296179 | Elapsed time: 0:0:10.789301 |
PID: 29807 | Start time: 0:0:34.476919 | End time: 0:0:45.339037 | Elapsed time: 0:0:10.862118 |
PID: 29794 | Start time: 0:0:34.260400 | End time: 0:0:45.341766 | Elapsed time: 0:0:11.81366 |
PID: 29806 | Start time: 0:0:34.446373 | End time: 0:0:45.382175 | Elapsed time: 0:0:10.935802 |
PID: 29796 | Start time: 0:0:34.277009 | End time: 0:0:45.383935 | Elapsed time: 0:0:11.106926 |
PID: 29793 | Start time: 0:0:34.244972 | End time: 0:0:45.437593 | Elapsed time: 0:0:11.192621 |
PID: 29809 | Start time: 0:0:34.508361 | End time: 0:0:45.448452 | Elapsed time: 0:0:10.940091 |
PID: 29810 | Start time: 0:0:34.536881 | End time: 0:0:45.459317 | Elapsed time: 0:0:10.922436 |
Scheduling Policy: RT_FIFO | Average Elapsed Time::10.897404
root@ubuntu:/home/id20212211/Desktop#
```

라. RT_RR(TimeSlice: 10 ms)를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
4
Input Time Slice to apply:
1. 10ms
2. 100ms
3. 1000ms
1
PID: 29851 | Start time: 0:1:32.647204 | End time: 0:1:43.112709 | Elapsed time: 0:0:10.465505 |
PID: 29854 | Start time: 0:1:32.767262 | End time: 0:1:43.168535 | Elapsed time: 0:0:10.401273 |
PID: 29847 | Start time: 0:1:32.587271 | End time: 0:1:43.199585 | Elapsed time: 0:0:10.612314 |
PID: 29850 | Start time: 0:1:32.632199 | End time: 0:1:43.453905 | Elapsed time: 0:0:10.821706 |
PID: 29846 | Start time: 0:1:32.564072 | End time: 0:1:43.234484 | Elapsed time: 0:0:10.670412 |
PID: 29835 | Start time: 0:1:32.423084 | End time: 0:1:43.255964 | Elapsed time: 0:0:10.832880 |
PID: 29848 | Start time: 0:1:32.602221 | End time: 0:1:43.265874 | Elapsed time: 0:0:10.663653 |
PID: 29843 | Start time: 0:1:32.527258 | End time: 0:1:43.310423 | Elapsed time: 0:0:10.783165 |
PID: 29840 | Start time: 0:1:32.497189 | End time: 0:1:43.322996 | Elapsed time: 0:0:10.825807 |
PID: 29852 | Start time: 0:1:32.675233 | End time: 0:1:43.356379 | Elapsed time: 0:0:10.681146 |
PID: 29839 | Start time: 0:1:32.470171 | End time: 0:1:43.361444 | Elapsed time: 0:0:10.891273 |
PID: 29836 | Start time: 0:1:32.452055 | End time: 0:1:43.386448 | Elapsed time: 0:0:10.934393 |
PID: 29841 | Start time: 0:1:32.500077 | End time: 0:1:43.391984 | Elapsed time: 0:0:10.891907 |
PID: 29838 | Start time: 0:1:32.469756 | End time: 0:1:43.408416 | Elapsed time: 0:0:10.938660 |
PID: 29853 | Start time: 0:1:32.707225 | End time: 0:1:43.433671 | Elapsed time: 0:0:10.726446 |
PID: 29855 | Start time: 0:1:32.797257 | End time: 0:1:43.437026 | Elapsed time: 0:0:10.639769 |
PID: 29844 | Start time: 0:1:32.532060 | End time: 0:1:43.438438 | Elapsed time: 0:0:10.906378 |
PID: 29837 | Start time: 0:1:32.467966 | End time: 0:1:43.439580 | Elapsed time: 0:0:10.971614 |
PID: 29845 | Start time: 0:1:32.557751 | End time: 0:1:43.442707 | Elapsed time: 0:0:10.884956 |
PID: 29842 | Start time: 0:1:32.504731 | End time: 0:1:43.448075 | Elapsed time: 0:0:10.943344 |
PID: 29849 | Start time: 0:1:32.629697 | End time: 0:1:43.466397 | Elapsed time: 0:0:10.836700 |
Scheduling Policy: RT_RR | Time Quantum: 10 ms | Average Elapsed Time::10.777300
root@ubuntu:/home/id20212211/Desktop#
```

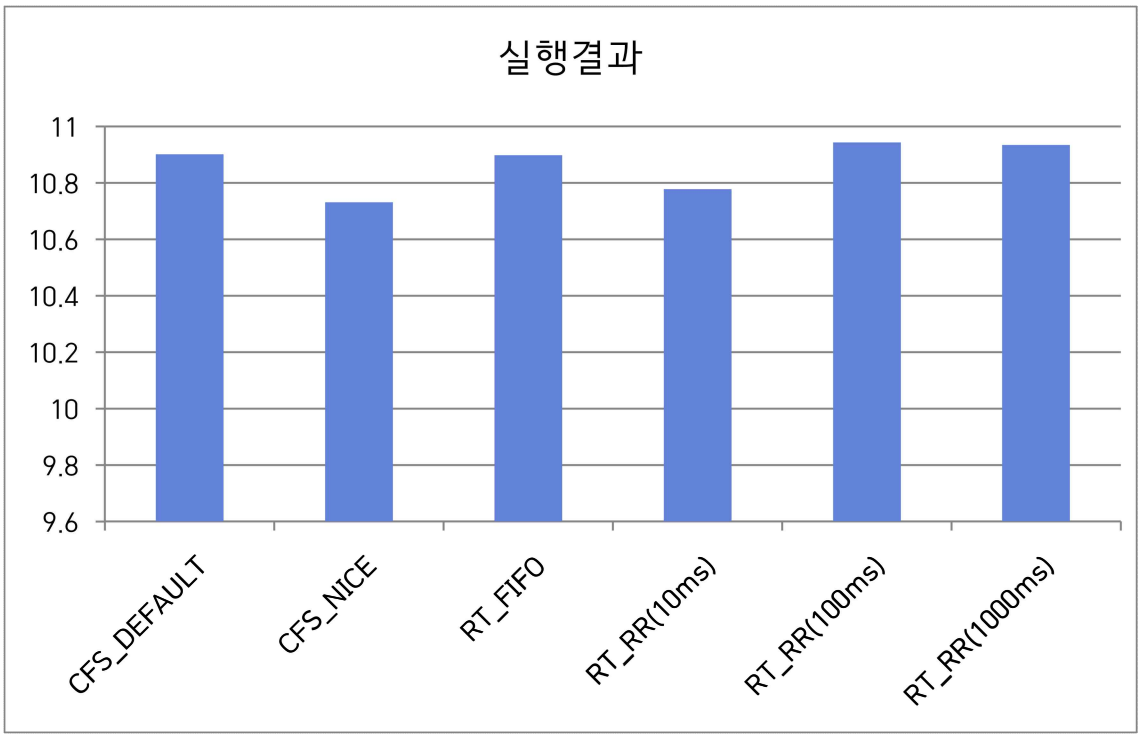
마. RT_RR(TimeSlice: 100 ms)를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
4
Input Time Slice to apply:
1. 10ms
2. 100ms
3. 1000ms
2
PID: 29889 | Start time: 0:2:17.337242 | End time: 0:2:28.9863 | Elapsed time: 0:0:10.672621 |
PID: 29881 | Start time: 0:2:17.227610 | End time: 0:2:28.77787 | Elapsed time: 0:0:10.850177 |
PID: 29898 | Start time: 0:2:17.467169 | End time: 0:2:28.110640 | Elapsed time: 0:0:10.643471 |
PID: 29897 | Start time: 0:2:17.435157 | End time: 0:2:28.141638 | Elapsed time: 0:0:10.706481 |
PID: 29892 | Start time: 0:2:17.371137 | End time: 0:2:28.158930 | Elapsed time: 0:0:10.787793 |
PID: 29887 | Start time: 0:2:17.305228 | End time: 0:2:28.342137 | Elapsed time: 0:0:11.36909 |
PID: 29884 | Start time: 0:2:17.259967 | End time: 0:2:28.202668 | Elapsed time: 0:0:10.942701 |
PID: 29890 | Start time: 0:2:17.347729 | End time: 0:2:28.217036 | Elapsed time: 0:0:10.869307 |
PID: 29888 | Start time: 0:2:17.332840 | End time: 0:2:28.233466 | Elapsed time: 0:0:10.900626 |
PID: 29883 | Start time: 0:2:17.259530 | End time: 0:2:28.263142 | Elapsed time: 0:0:11.3612 |
PID: 29896 | Start time: 0:2:17.407739 | End time: 0:2:28.382944 | Elapsed time: 0:0:10.975205 |
PID: 29899 | Start time: 0:2:17.497755 | End time: 0:2:28.282348 | Elapsed time: 0:0:10.784593 |
PID: 29880 | Start time: 0:2:17.225279 | End time: 0:2:28.293873 | Elapsed time: 0:0:11.68594 |
PID: 29895 | Start time: 0:2:17.403147 | End time: 0:2:28.316000 | Elapsed time: 0:0:10.912853 |
PID: 29886 | Start time: 0:2:17.302530 | End time: 0:2:28.327256 | Elapsed time: 0:0:11.24726 |
PID: 29891 | Start time: 0:2:17.353247 | End time: 0:2:28.327412 | Elapsed time: 0:0:10.974165 |
PID: 29879 | Start time: 0:2:17.201770 | End time: 0:2:28.363010 | Elapsed time: 0:0:11.161240 |
PID: 29894 | Start time: 0:2:17.401326 | End time: 0:2:28.391118 | Elapsed time: 0:0:10.989792 |
PID: 29893 | Start time: 0:2:17.377725 | End time: 0:2:28.457899 | Elapsed time: 0:0:11.80174 |
PID: 29882 | Start time: 0:2:17.257723 | End time: 0:2:28.468745 | Elapsed time: 0:0:11.211022 |
PID: 29885 | Start time: 0:2:17.273245 | End time: 0:2:28.468994 | Elapsed time: 0:0:11.195749 |
Scheduling Policy: RT_RR | Time Quantum: 100 ms | Average Elapsed Time::10.942467
root@ubuntu:/home/id20212211/Desktop#
```

바. RT_RR(TimeSlice: 1000 ms)를 실행했을 때

```
Input the Scheduling Policy to apply:
1. CFS_Default
2. CFS_NICE
3. RT_FIFO
4. RT_RR
4
Input Time Slice to apply:
1. 10ms
2. 100ms
3. 1000ms
3
PID: 29926 | Start time: 0:2:51.156163 | End time: 0:3:61.938312 | Elapsed time: 0:1:10.782149 |
PID: 29932 | Start time: 0:2:51.209265 | End time: 0:3:62.262530 | Elapsed time: 0:1:11.53265 |
PID: 29941 | Start time: 0:2:51.323655 | End time: 0:3:61.971029 | Elapsed time: 0:1:10.647374 |
PID: 29931 | Start time: 0:2:51.203543 | End time: 0:3:61.995390 | Elapsed time: 0:1:10.791847 |
PID: 29937 | Start time: 0:2:51.263125 | End time: 0:3:62.15284 | Elapsed time: 0:1:10.752159 |
PID: 29933 | Start time: 0:2:51.211558 | End time: 0:3:62.60997 | Elapsed time: 0:1:10.849439 |
PID: 29935 | Start time: 0:2:51.241283 | End time: 0:3:62.73797 | Elapsed time: 0:1:10.832514 |
PID: 29925 | Start time: 0:2:51.153542 | End time: 0:3:62.88475 | Elapsed time: 0:1:10.934933 |
PID: 29927 | Start time: 0:2:51.157341 | End time: 0:3:62.110664 | Elapsed time: 0:1:10.953323 |
PID: 29928 | Start time: 0:2:51.162563 | End time: 0:3:62.150531 | Elapsed time: 0:1:10.987968 |
PID: 29934 | Start time: 0:2:51.233635 | End time: 0:3:62.172622 | Elapsed time: 0:1:10.938987 |
PID: 29940 | Start time: 0:2:51.321285 | End time: 0:3:62.186560 | Elapsed time: 0:1:10.865275 |
PID: 29929 | Start time: 0:2:51.184694 | End time: 0:3:62.216446 | Elapsed time: 0:1:11.31752 |
PID: 29930 | Start time: 0:2:51.188048 | End time: 0:3:62.228710 | Elapsed time: 0:1:11.40662 |
PID: 29938 | Start time: 0:2:51.287142 | End time: 0:3:62.230590 | Elapsed time: 0:1:10.943448 |
PID: 29943 | Start time: 0:2:51.383204 | End time: 0:3:62.232668 | Elapsed time: 0:1:10.849464 |
PID: 29942 | Start time: 0:2:51.351694 | End time: 0:3:62.233568 | Elapsed time: 0:1:10.881874 |
PID: 29939 | Start time: 0:2:51.293651 | End time: 0:3:62.234919 | Elapsed time: 0:1:10.941268 |
PID: 29936 | Start time: 0:2:51.261874 | End time: 0:3:62.326184 | Elapsed time: 0:1:11.64310 |
PID: 29924 | Start time: 0:2:51.128615 | End time: 0:3:62.343648 | Elapsed time: 0:1:11.215033 |
PID: 29923 | Start time: 0:2:51.105178 | End time: 0:3:62.346997 | Elapsed time: 0:1:11.241819 |
Scheduling Policy: RT_RR | Time Quantum: 1000 ms | Average Elapsed Time::10.933279
root@ubuntu:/home/id20212211/Desktop#
```

3. 부연설명



프로그램은 총 21번의 자식 프로세스를 할당한다. 스케줄러는 SYS_sched_setattr를 이용하였다.
할당과정에서 유의할 점은, CFS 스케줄러는 필수적으로 nice값을 반영한다. 따라서 기본CFS는 0, CFS_NICE는 -20, 0, 19를 각각 7개씩 적용하였다. RT스케줄러는 sched_priority를 일괄적으로 95로 적용하였다. 추가적으로 RT_RR의 time slice는 sched_period를 이용해 사용자가 지정한 timeslice를 적용하였다.
소요시간계산은 gettimeofday의 tv_sec와 tv_usec를 이용해 계산하였다.
mmap()함수를 사용해 ElapsedTime를 부모프로세스로 전달한다.

가장 최소 시간으로 작동하는 스케줄러: Nice 값이 적용된 CFS
두 번째로 최소 시간으로 작동하는 스케줄러: Time Quantum이 10ms인 라운드 로빈
세 번째로 최소 시간으로 작동하는 스케줄러: FCFS
네 번째로 최소 시간으로 작동하는 스케줄러: 기본 CFS
다섯 번째와 여섯 번째로 작동 시간에 큰 차이가 나타나지 않은 스케줄러: Time Quantum이 각각 1000ms와 100ms인 라운드 로빈