

Homework 2

Name: Bijon Setyawan Raya 林湧

Student No. : 104062181

Listing Tasks Linearly

The result with `dmesg` command

```
Activities  Tmux  Thu Apr 4 9:14 PM
1/1 +  Tmux: Default
22.188717] 12:48:44.757948 main 6.0.4 r128413 started. Verbose level = 0
22.183374] 12:48:44.768599 main vbg1R3GuestCtrlDetectPeekGetCancelSupport: Supported (#1)
1516.716495] rfkll: input handler disabled
1551.820310] Start listing tasks linearly
1551.820311] pid: 1 | pname: systemd | state: 1
1551.820314] pid: 2 | pname: kthreadd | state: 1
1551.820316] pid: 3 | pname: rcu_gp | state: 1026
1551.820317] pid: 4 | pname: rcu_par_gp | state: 1026
1551.820318] pid: 6 | pname: kworker/0:0H | state: 1026
1551.820319] pid: 8 | pname: mm_percpu_wq | state: 1026
1551.820321] pid: 9 | pname: ksoftirqd/0 | state: 1
1551.820322] pid: 10 | pname: rcu_sched | state: 1026
1551.820323] pid: 11 | pname: rcu_bh | state: 1026
1551.820324] pid: 12 | pname: migration/0 | state: 1
1551.820325] pid: 13 | pname: watchdog/0 | state: 1
1551.820327] pid: 14 | pname: cpuhp/0 | state: 1
1551.820328] pid: 15 | pname: kdevtmpfs | state: 1
1551.820329] pid: 16 | pname: netns | state: 1026
1551.820330] pid: 17 | pname: rcu_tasks_kthre | state: 1
1551.820331] pid: 18 | pname: kauditd | state: 1
1551.820332] pid: 19 | pname: khungtaskd | state: 1
1551.820334] pid: 20 | pname: oom_reaper | state: 1
1551.820335] pid: 21 | pname: writeback | state: 1026
1551.820336] pid: 22 | pname: kcompactd0 | state: 1
1551.820337] pid: 23 | pname: ksmd | state: 1
1551.820338] pid: 24 | pname: khugepaged | state: 1
1551.820340] pid: 25 | pname: crypto | state: 1026
1551.820341] pid: 26 | pname: kintegrityd | state: 1026
1551.820342] pid: 27 | pname: kblockd | state: 1026
1551.820343] pid: 28 | pname: ata_sff | state: 1026
1551.820346] pid: 29 | pname: md | state: 1026
1551.820349] pid: 30 | pname: edac-poller | state: 1026
1551.820351] pid: 31 | pname: devfreq_wq | state: 1026
1551.820353] pid: 32 | pname: watchdogd | state: 1
1551.820354] pid: 33 | pname: kworker/0:1 | state: 1026
1551.820355] pid: 36 | pname: kswapd0 | state: 1
1551.820357] pid: 37 | pname: kworker/u3:0 | state: 1026
1551.820358] pid: 38 | pname: ecryptfs-kthrea | state: 1
1551.820359] pid: 83 | pname: kthrotld | state: 1026
1551.820360] pid: 84 | pname: acpi_thermal_pm | state: 1026
1551.820372] pid: 85 | pname: scsi_ah_0 | state: 1
1551.820374] pid: 86 | pname: scsi_tm_f_0 | state: 1026
1551.820375] pid: 87 | pname: scsi_ah_1 | state: 1
1551.820376] pid: 88 | pname: scsi_tm_f_1 | state: 1026
1551.820377] pid: 94 | pname: ipv6_addrconf | state: 1026
1551.820378] pid: 103 | pname: kstrp | state: 1026
1551.820380] pid: 120 | pname: charger_manager | state: 1026
1551.820381] pid: 161 | pname: kworker/0:2 | state: 1026
1551.820382] pid: 173 | pname: scsi_ah_2 | state: 1
1551.820383] pid: 175 | pname: scsi_tm_f_2 | state: 1026
1551.820384] pid: 186 | pname: ttm_swap | state: 1026
1551.820385] pid: 189 | pname: irq/18-vmwgfx | state: 1
1551.820387] pid: 193 | pname: kworker/0:1H | state: 1026
```

The result with `ps -e1` command

```
Activities TiliX - Thu Apr 4 9:16 PM
TiliX: Default

1551.820590 pid: 2601 | pname: zsh | state: 1
1551.820591 pid: 2606 | pname: kworker/u2:0 | state: 1026
1551.820593 pid: 3185 | pname: sudo | state: 1
1551.820594 pid: 3199 | pname: insmod | state: 0
1551.820594 Stop listing task linearly

#W2 ps -e1
# PID PS -e1
F S UID PID PPID C PRI NI ADDR SZ WCHAN TTY TIME CMD
4 S 0 1 0 0 80 0 - 31294 - ? 00:00:01 systemd
1 S 0 2 0 0 80 0 - 0 - ? 00:00:00 kthreadd
1 I 0 3 2 0 60 -20 - 0 - ? 00:00:00 rcu_gp
1 I 0 4 2 0 60 -20 - 0 - ? 00:00:00 rcu_par_gp
1 I 0 6 2 0 60 -20 - 0 - ? 00:00:00 kworker/0:0H-kblockd
1 I 0 8 2 0 60 -20 - 0 - ? 00:00:00 mm_percpu_wq
1 S 0 9 2 0 80 0 - 0 - ? 00:00:00 ksoftirqd/0
1 I 0 10 2 0 80 0 - 0 - ? 00:00:00 rcu_sched
1 I 0 11 2 0 80 0 - 0 - ? 00:00:00 rcu_bh
1 S 0 12 2 0 -40 - - 0 - ? 00:00:00 migration/0
5 S 0 13 2 0 -40 - - 0 - ? 00:00:00 watchdog/0
1 S 0 14 2 0 80 0 - 0 - ? 00:00:00 cpuhp/0
5 S 0 15 2 0 80 0 - 0 - ? 00:00:00 kdevtmpfs
1 I 0 16 2 0 60 -20 - 0 - ? 00:00:00 netns
1 S 0 17 2 0 80 0 - 0 - ? 00:00:00 rcu_tasks_kthre
1 S 0 18 2 0 80 0 - 0 - ? 00:00:00 kauditd
1 S 0 19 2 0 80 0 - 0 - ? 00:00:00 khungtaskd
1 S 0 20 2 0 80 0 - 0 - ? 00:00:00 oom_reaper
1 I 0 21 2 0 60 -20 - 0 - ? 00:00:00 writeback
1 S 0 22 2 0 80 0 - 0 - ? 00:00:00 kcompactd0
1 S 0 23 2 0 85 5 - 0 - ? 00:00:00 ksm
1 S 0 24 2 0 99 19 - 0 - ? 00:00:00 khugepaged
1 I 0 25 2 0 60 -20 - 0 - ? 00:00:00 crypto
1 I 0 26 2 0 60 -20 - 0 - ? 00:00:00 kintegrityd
1 I 0 27 2 0 60 -20 - 0 - ? 00:00:00 kblockd
1 I 0 28 2 0 60 -20 - 0 - ? 00:00:00 ata_sff
1 I 0 29 2 0 60 -20 - 0 - ? 00:00:00 md
1 I 0 30 2 0 60 -20 - 0 - ? 00:00:00 edac-poller
1 I 0 31 2 0 60 -20 - 0 - ? 00:00:00 devfreq_wq
1 S 0 32 2 0 -40 - - 0 - ? 00:00:00 watchdogd
1 I 0 33 2 0 80 0 - 0 - ? 00:00:00 kworker/0:1-cgroup_destroy
1 S 0 36 2 0 80 0 - 0 - ? 00:00:00 kswapd0
1 I 0 37 2 0 60 -20 - 0 - ? 00:00:00 kworker/u3:0-kcryptd
1 S 0 38 2 0 80 0 - 0 - ? 00:00:00 ecryptfs-kthrea
1 I 0 83 2 0 60 -20 - 0 - ? 00:00:00 kthrotld
1 I 0 84 2 0 60 -20 - 0 - ? 00:00:00 acpi_thermal_pm
1 S 0 85 2 0 80 0 - 0 - ? 00:00:00 scsi_eh_0
1 I 0 86 2 0 60 -20 - 0 - ? 00:00:00 scsi_tm_f_0
1 S 0 87 2 0 80 0 - 0 - ? 00:00:00 scsi_eh_1
1 I 0 88 2 0 60 -20 - 0 - ? 00:00:00 scsi_tm_f_1
1 I 0 94 2 0 60 -20 - 0 - ? 00:00:00 ipv6_addrconf
1 I 0 103 2 0 60 -20 - 0 - ? 00:00:00 kstrp
1 I 0 120 2 0 60 -20 - 0 - ? 00:00:00 charger_manager
1 I 0 161 2 0 80 0 - 0 - ? 00:00:00 kworker/0:2-events
1 S 0 173 2 0 80 0 - 0 - ? 00:00:00 scsi_eh_2
1 I 0 175 2 0 60 -20 - 0 - ? 00:00:00 scsi_tm_f_2
```

Each of the process listed in the picture above has the same PIDs and the same name, therefore my code works properly as intended.

```
int start (void) {
    struct task_struct *task;

    printk(KERN_INFO "Start listing tasks linearly\n");
    for_each_process (task) {
        printk(KERN_INFO "pid: %d | pname: %-20s | state: %ld", task->pid, task->comm,
        task->state);
    }
    printk(KERN_INFO "Stop listing task linearly");
    return 0;
}
```

This is the main part of the code for listing task linearly. It basically creates a pointer named `task` that has all properties of a task in an operating system. Later on, I use `for_each_process()` to iterate all the tasks linearly from the first task to the n-th and print out all the id, name and the state of each task linearly.

Listing Tasks Using Depth-First-Search Data Structure

The result with `dmesg` command

```

Activities Terminal
Thu Apr 4 8:44 PM
john_bjohn@pop-os: ~/Documents/os_hw/HW2_2

File Edit View Search Terminal Help

1065,044884 pid: 28 | pname: ata_sff | state: 1026
1065,044885 pid: 29 | pname: md | state: 1026
1065,044886 pid: 30 | pname: edac-poller | state: 1026
1065,044887 pid: 31 | pname: devfreq_wq | state: 1026
1065,044887 pid: 32 | pname: watchdogd | state: 1
1065,044888 pid: 33 | pname: kworker/0:1 | state: 1026
1065,044889 pid: 34 | pname: kworker/u2:1 | state: 1026
1065,044890 pid: 36 | pname: kswapd0 | state: 1
1065,044890 pid: 37 | pname: kworker/u3:0 | state: 1026
1065,044891 pid: 38 | pname: ecryptfs-kthrea | state: 1
1065,044892 pid: 83 | pname: kthrotld | state: 1026
1065,044892 pid: 84 | pname: acpi_thermal_pm | state: 1026
1065,044893 pid: 85 | pname: scsi_eh_0 | state: 1
1065,044894 pid: 86 | pname: scsi_tm_f_0 | state: 1026
1065,044895 pid: 87 | pname: scsi_eh_1 | state: 1
1065,044895 pid: 88 | pname: scsi_tm_f_1 | state: 1026
1065,044896 pid: 94 | pname: ipv6_addrconf | state: 1026
1065,044897 pid: 103 | pname: kstrp | state: 1026
1065,044897 pid: 120 | pname: charger_manager | state: 1026
1065,044898 pid: 161 | pname: kworker/0:2 | state: 1026
1065,044899 pid: 163 | pname: scsi_eh_2 | state: 1
1065,044900 pid: 164 | pname: scsi_tm_f_2 | state: 1026
1065,044901 pid: 175 | pname: tt_m_swap | state: 1026
1065,044901 pid: 177 | pname: irq/18-vmwgfx | state: 1
1065,044902 pid: 182 | pname: kworker/0:1H | state: 1026
1065,044903 pid: 262 | pname: raid5wq | state: 1026
1065,044903 pid: 321 | pname: kdmflush | state: 1026
1065,044904 pid: 322 | pname: kcryptd_io | state: 1026
1065,044905 pid: 323 | pname: kcryptd | state: 1026
1065,044905 pid: 324 | pname: dmccrypt_write | state: 1026
1065,044906 pid: 328 | pname: kworker/u3:1 | state: 1026
1065,044907 pid: 338 | pname: kdmflush | state: 1026
1065,044908 pid: 377 | pname: jbd2/dm-1-8 | state: 1
1065,044908 pid: 378 | pname: ext4-rsv-conver | state: 1026
1065,044909 pid: 487 | pname: iprt-VBoxQueue | state: 1026
1065,044910 pid: 554 | pname: kdmflush | state: 1026
1065,044911 pid: 555 | pname: kcryptd_io | state: 1026
1065,044911 pid: 550 | pname: kcryptd | state: 1026
1065,044912 pid: 559 | pname: dmccrypt_write | state: 1
1065,044913 pid: 610 | pname: jbd2/sdal-8 | state: 1
1065,044913 pid: 611 | pname: ext4-rsv-conver | state: 1026
1065,044914 pid: 3210 | | pname: kworker/u2:2 | state: 1026
1065,044915 pid: 3812 | | pname: kworker/0:0 | state: 1026
1065,044915 Finish listing tasks with DFS Data Structure
1162,044875 DONE!!!
+ HW2_2

```

The result with `ps -eF1` command

```

Activities Terminal
Thu Apr 4 8:47 PM
john_bjohn@pop-os: ~/Documents/os_hw/HW2_2

File Edit View Search Terminal Help

root 103 2 103 0 1 20:25 ? 00:00:00 [kstrp]
root 120 2 120 0 1 20:25 ? 00:00:00 [charger_manager]
root 161 2 161 0 1 20:25 ? 00:00:00 [kworker/0:2-cgroup_destroy]
root 163 2 163 0 1 20:25 ? 00:00:00 [scsi_eh_2]
root 164 2 164 0 1 20:25 ? 00:00:00 [scsi_tm_f_2]
root 175 2 175 0 1 20:25 ? 00:00:00 [ttm_swap]
root 177 2 177 0 1 20:25 ? 00:00:00 [irq/18-vmwgfx]
root 182 2 182 0 1 20:25 ? 00:00:00 [kworker/0:1H-kblockd]
root 262 2 262 0 1 20:25 ? 00:00:00 [raid5wq]
root 321 2 321 0 1 20:25 ? 00:00:00 [kdmflush]
root 322 2 322 0 1 20:25 ? 00:00:00 [kcryptd_io]
root 323 2 323 0 1 20:25 ? 00:00:00 [kcryptd]
root 324 2 324 0 1 20:25 ? 00:00:00 [dmccrypt_write]
root 328 2 328 0 1 20:25 ? 00:00:01 [kworker/u3:1-kcryptd]
root 338 2 338 0 1 20:25 ? 00:00:00 [kdmflush]
root 377 2 377 0 1 20:25 ? 00:00:00 [jbd2/dm-1-8]
root 378 2 378 0 1 20:25 ? 00:00:00 [ext4-rsv-conver]
root 422 1 422 0 1 20:25 ? 00:00:00 /lib/systemd/systemd-journald
root 463 1 463 0 1 20:25 ? 00:00:00 /lib/systemd/systemd-udev
root 487 2 487 0 1 20:25 ? 00:00:00 [iprt-VBoxQueue]
root 554 2 554 0 1 20:25 ? 00:00:00 [kdmflush]
root 555 2 555 0 1 20:25 ? 00:00:00 [kcryptd_io]
root 558 2 558 0 1 20:25 ? 00:00:00 [kcryptd]
root 559 2 559 0 1 20:25 ? 00:00:00 [dmccrypt_write]
root 610 2 610 0 1 20:25 ? 00:00:00 [jbd2/sdal-8]
root 611 2 611 0 1 20:25 ? 00:00:00 [ext4-rsv-conver]
systemd+ 624 1 624 0 1 20:25 ? 00:00:00 /lib/systemd/systemd-resolved
systemd+ 625 1 625 0 2 20:25 ? 00:00:00 /lib/systemd/systemd-timesyncd
systemd+ 625 1 662 0 2 20:25 ? 00:00:00 /lib/systemd/systemd-timesyncd
root 703 1 703 0 1 20:25 ? 00:00:00 /usr/bin/python3 /usr/bin/networkd-dispatcher --run-startup-triggers
root 714 1 714 0 1 20:25 ? 00:00:00 /usr/sbin/cupsd -l
root 715 1 715 0 1 20:25 ? 00:00:00 /lib/systemd/systemd-logind
root 719 1 719 0 3 20:25 ? 00:00:00 /usr/sbin/ModemManager --filter-policy=strict
root 719 1 803 0 3 20:25 ? 00:00:00 /usr/sbin/ModemManager --filter-policy=strict
root 719 1 836 0 3 20:25 ? 00:00:00 /usr/sbin/ModemManager --filter-policy=strict
root 764 1 764 0 1 20:25 ? 00:00:00 /usr/sbin/cron -f
root 769 1 769 0 5 20:25 ? 00:00:00 /usr/lib/udisks2/udisksd
root 769 1 807 0 5 20:25 ? 00:00:00 /usr/lib/udisks2/udisksd
root 769 1 837 0 5 20:25 ? 00:00:00 /usr/lib/udisks2/udisksd
root 769 1 856 0 5 20:25 ? 00:00:00 /usr/lib/udisks2/udisksd
root 769 1 873 0 5 20:25 ? 00:00:00 /usr/lib/udisks2/udisksd
root 772 1 772 0 3 20:25 ? 00:00:00 /usr/lib/accountsservice/accounts-daemon
root 772 1 779 0 3 20:25 ? 00:00:00 /usr/lib/accountsservice/accounts-daemon
root 772 1 835 0 3 20:25 ? 00:00:00 /usr/lib/accountsservice/accounts-daemon
message+ 778 1 778 0 1 20:25 ? 00:00:00 /usr/bin/dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only
root 786 1 786 0 3 20:25 ? 00:00:00 /usr/bin/NetworkManager --no-daemon
root 786 1 850 0 3 20:25 ? 00:00:00 /usr/bin/NetworkManager --no-daemon

```

Each of the process listed in the picture above has the same PIDs and the same name, therefore my code works properly as intended.

```

void depth_first_search (struct task_struct *task) {
    struct list_head *children_list;
    struct task_struct *new_child;

    printk(KERN_INFO "pid: %d\t | pname: %-20s\t | state: %ld\n", task->pid, task->comm,
    task->state);
}

```

```

// loop over children_list pointer
list_for_each (children_list, &task->children) {
    // initialize a new child that points to the next child
    new_child = list_entry(children_list, struct task_struct, sibling);

    // iterate from new_child
    depth_first_search(new_child);
}
}

```

This is the main part of the code for listing task using Depth First Search Data Structure. It basically passing a pointer called `task()` to the function that I made called `depth_first_search()`, and print each task's properties from the root node.

After printing the root node's properties, it needs to list out both of its children's properties. Before listing them out, we need to pass `children_list` that acts a list_head pointer and `&task->children` that acts as the struct of each child in `children_list`.

After passing those parameters, I immediately initialize a new child that points to the next child and store this new child into `children_list`.

Finally, recall `depth_first_function()` again and pass `new_child` as a parameter. For the next recursive, this `new_child` acts as parent node.