

Данные о текущей конфигурации операционной системы

- Общий объем оперативной памяти: 1870900 КБ = 1827,05 МБ = 1,78 ГБ
- Объем раздела подкачки: 839676 КБ = 820 МБ
- Размер страницы виртуальной памяти: 4096 КБ
- Объем свободной физической памяти в ненагруженной системе: 1472108 КБ = 1 437,61 МБ
- Объем свободного пространства в разделе подкачки в ненагруженной системе: 839676 КБ

Эксперимент №1

Подготовительный этап:

Скрипт mem.bash, который выполняет бесконечный цикл. Перед началом выполнения цикла создается пустой массив и счетчик шагов, равный 0. На каждом шаге цикла в конец массива добавляется последовательность из 10 элементов: (1 2 3 4 5 6 7 8 9 10).

```
#!/bin/bash

> report.log

array=()
step=0

while true; do
array+=({1..10})
step=$((step + 1))
if (( step % 100000 == 0 )); then
echo "Step $step: Array size is ${#array[@]}" >> report.log
fi
done
```

Каждый 100000-ый шаг в файл report.log добавляется строка с текущим значением размера массива (перед запуском скрипта файл обнуляется).

Первый этап:

Вывод последних сообщений системного журнала – параметры, с которыми произошла аварийная остановка процесса

PID: 1485

Общий объем виртуальной памяти, используемой процессом: 2658416kB = 2,54GB

Объем анонимной резидентной памяти, используемой процессом: 1685984kB = 1,61GB

```
[ 1603.255530] [ 1485] 0 1485 664604 421496 4947968 187492 0 mem.bash
[ 1603.255780] Out of memory: Killed process 1485 (mem.bash) total-vm:2658416kB, anon-rss:1685984kB,
file-rss:0kB, shmem-rss:0kB, UID:0
[ 1603.382220] oom_reaper: reaped process 1485 (mem.bash), now anon-rss:0kB, file-rss:0kB, shmem-rss:0kB
Killed
```

Последняя строка файла report.log

```
Array size is 31000000
```

Наблюдение за выводом команды top раз в секунду, после запуска mem.bash

```
Iteration 1
MiB Mem : 1826.8 total, 1410.2 free, 190.5 used, 226.1 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 1484.8 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   257072   37788   2936 R   68.4    2.0   0:00.40 mem.bash
 1454 root        20   0   268556   49140   2936 R   75.0    2.6   0:00.54 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 2
MiB Mem : 1826.8 total, 1301.0 free, 299.5 used, 226.3 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 1375.8 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   366632  147348   2936 R   81.2    7.9   0:01.72 mem.bash
 1454 root        20   0   378512  158964   2936 R   80.0    8.5   0:01.85 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 3
MiB Mem : 1826.8 total, 1195.8 free, 404.7 used, 226.3 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 1270.6 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   475796  256380   2936 R   82.4   13.7   0:03.00 mem.bash
 1454 root        20   0   487544  267996   2936 R   81.2   14.3   0:03.13 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 4
MiB Mem : 1826.8 total, 1090.7 free, 509.8 used, 226.3 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 1165.5 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   581660  362244   2936 R   80.0   19.4   0:04.25 mem.bash
 1454 root        20   0   593672  374388   2936 R   81.2   20.0   0:04.40 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 5
MiB Mem : 1826.8 total, 986.2 free, 614.3 used, 226.3 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 1061.1 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   688712  469428   2936 R   82.4   25.1   0:05.54 mem.bash
 1454 root        20   0   699272  479724   2936 R   81.2   25.6   0:05.67 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 6
MiB Mem : 1826.8 total, 896.9 free, 703.6 used, 226.3 buff/cache
MiB Swap: 820.0 total, 820.0 free, 0.0 used, 971.8 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1454 root        20   0   775700  556284   2936 R   68.4   29.7   0:06.78 mem.bash
 1454 root        20   0   786656  567372   2936 R   73.3   30.3   0:06.91 mem.bash
    1 root        20   0   179188   13456   8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0        0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0        0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```

Iteration 7
MiB Mem : 1826.8 total,      813.5 free,      787.0 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      888.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0   864800   645252   2936 R   68.8   34.5   0:08.00 mem.bash
 1454 root        20   0   876284   656868   2936 R   75.0   35.1   0:08.14 mem.bash
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_par_gp

```

```

Iteration 8
MiB Mem : 1826.8 total,      730.8 free,      869.7 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      805.6 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0   947036   727620   2936 R   65.0   38.9   0:09.23 mem.bash
 1454 root        20   0   958652   739236   2936 R   76.5   39.5   0:09.37 mem.bash
 1531 root        20   0   274140    4428    3852 R    5.9    0.2   0:00.01 top
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp

```

```

Iteration 9
MiB Mem : 1826.8 total,      628.8 free,      971.7 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      703.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0  1052504   833220   2936 R   80.0   44.5   0:10.50 mem.bash
 1454 root        20   0  1062536   842988   2936 R   73.3   45.1   0:10.63 mem.bash
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_par_gp

```

```

Iteration 10
MiB Mem : 1826.8 total,      531.6 free,     1068.9 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      606.5 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0  1152296   933012   2936 R   75.0   49.9   0:11.76 mem.bash
 1454 root        20   0  1164176   944628   2936 R   76.5   50.5   0:11.91 mem.bash
 363 root        20   0         0         0         0 I    5.9    0.0   0:00.27 kworker/0:3-ata_sff
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp

```

```

Iteration 11
MiB Mem : 1826.8 total,      427.9 free,     1172.6 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      502.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0  1259612    1.0g   2936 R   76.5   55.6   0:13.05 mem.bash
 1454 root        20   0  1271360    1.0g   2936 R   80.0   56.2   0:13.18 mem.bash
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_par_gp

```

```

Iteration 12
MiB Mem : 1826.8 total,      324.0 free,     1276.5 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      398.9 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0  1364816    1.1g   2936 R   81.2   61.2   0:14.31 mem.bash
 1454 root        20   0  1376960    1.1g   2936 R   81.2   61.9   0:14.45 mem.bash
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_par_gp

```

```

Iteration 13
MiB Mem : 1826.8 total,      219.4 free,     1381.1 used,      226.3 buff/cache
MiB Swap:  820.0 total,      820.0 free,        0.0 used.      294.3 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1454 root        20   0  1472132    1.2g   2936 R   81.2   67.0   0:15.59 mem.bash
 1454 root        20   0  1483748    1.2g   2936 R   80.0   67.6   0:15.72 mem.bash
    1 root        20   0   179188   13456    8508 S    0.0    0.7   0:02.33 systemd
    2 root        20   0         0         0         0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20         0         0         0 I    0.0    0.0   0:00.00 rcu_par_gp

```

Iteration 14										
MiB Mem :		1826.8 total,		116.2 free,		1484.2 used,		226.3 buff/cache		
MiB Swap:		820.0 total,		820.0 free,		0.0 used.		191.1 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1454	root	20	0	1578392	1.3g	2936	R	73.7	72.7	0:16.86 mem.bash
1454	root	20	0	1590668	1.3g	2936	R	82.4	73.3	0:17.00 mem.bash
1	root	20	0	179188	13456	8508	S	0.0	0.7	0:02.33 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_par_gp

Iteration 15										
MiB Mem :		1826.8 total,		1681.3 free,		90.6 used,		54.9 buff/cache		
MiB Swap:		820.0 total,		820.0 free,		0.0 used.		1635.8 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1	root	20	0	179192	2480	2264	S	0.0	0.1	0:02.55 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_par_gp
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/0:0H-kblockd

Последние записи о скрипте mem.bash в системном журнале

```
[root@localhost lab5]# dmesg | grep "mem.bash"
[ 185.067330] mem.bash invoked oom-killer: gfp_mask=0x6200ca(GFP_HIGHUSER_MOVABLE), nodemask=(null), order=0, oom_score_adj=0
[ 185.067710] mem.bash cpuset=/ mems_allowed=0
[ 185.069038] CPU: 0 PID: 1454 Comm: mem.bash Kdump: loaded Tainted: G          -----r-
- 4.18.0-193.el8.x86_64 #1
[ 185.110982] [ 1454] 0 1454 659621 416664 4923392 187401 0 mem.bash
[ 185.111736] Out of memory: Killed process 1454 (mem.bash) total-vm:2638484kB, anon-rss:1666656kB, file-rss:0kB, shmem-rss:0kB, UID:0
[ 185.234798] oom_reaper: reaped process 1454 (mem.bash), now anon-rss:0kB, file-rss:0kB, shmem-rss:0kB
```

Последняя строка файла report.log

```
Array size is 30000000
```

Второй этап

Второй скрипт mem2.bash – копия скрипта mem.bash, записывает в файл report2.log

```
#!/bin/bash

> report2.log

array=()
step=0

while true; do
array+=({1..10})
step=$((step + 1))
if (( step % 100000 == 0 )); then
echo "Step $step: Array size is ${#array[@]}" >> report2.log
fi
done
```

Скрипт, который запускает mem.bash и mem2.bash в фоновом режиме

```
#!/bin/bash

./mem.bash &
./mem2.bash &
```

Наблюдение за выводом команды top раз в секунду, после запуска двух скриптов

Iteration 1										
MiB Mem :		1826.8 total,		1582.4 free,		111.6 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1575.5 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	236348	16916	2916	R	31.6	0.9	0:00.16 mem.bash
1703	root	20	0	236216	16912	2920	R	31.6	0.9	0:00.17 mem2.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

Iteration 2										
MiB Mem :		1826.8 total,		1486.5 free,		207.6 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1479.5 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1703	root	20	0	284000	64696	2920	R	43.8	3.5	0:00.78 mem2.bash
1702	root	20	0	285188	65756	2916	R	31.2	3.5	0:00.77 mem.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

Iteration 3										
MiB Mem :		1826.8 total,		1392.5 free,		301.6 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1385.5 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	335480	116180	2916	R	31.6	6.2	0:01.37 mem.bash
1703	root	20	0	330464	110896	2920	R	31.6	5.9	0:01.36 mem2.bash
1695	root	20	0	0	0	0	I	5.3	0.0	0:00.22 kworker/0:2-events
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd

Iteration 4										
MiB Mem :		1826.8 total,		1297.3 free,		396.8 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1290.4 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	384056	164756	2916	R	35.3	8.8	0:01.95 mem.bash
1703	root	20	0	379172	159736	2920	R	29.4	8.5	0:01.95 mem2.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

Iteration 5										
MiB Mem :		1826.8 total,		1200.3 free,		493.7 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1193.4 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	436460	217028	2916	R	35.0	11.6	0:02.57 mem.bash
1703	root	20	0	430124	210688	2920	R	30.0	11.3	0:02.56 mem2.bash
1695	root	20	0	0	0	0	I	5.0	0.0	0:00.23 kworker/0:2-events_power_ef+
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd

Iteration 6										
MiB Mem :		1826.8 total,		1100.1 free,		593.9 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		1093.2 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	486488	266924	2916	R	43.8	14.3	0:03.16 mem.bash
1703	root	20	0	479228	259792	2920	R	31.2	13.9	0:03.15 mem2.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

Iteration 7										
MiB Mem :		1826.8 total,		1001.2 free,		692.9 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		994.2 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	535856	316292	2916	R	40.0	16.9	0:03.74 mem.bash
1703	root	20	0	529784	310480	2920	R	40.0	16.6	0:03.75 mem2.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

Iteration 8										
MiB Mem :		1826.8 total,		921.4 free,		772.7 used,		132.7 buff/cache		
MiB Swap:		820.0 total,		735.3 free,		84.7 used.		914.4 avail Mem		
PID	USER	PR	NI	UIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
1702	root	20	0	574136	354572	2916	R	38.9	19.0	0:04.34 mem.bash
1703	root	20	0	565160	345856	2920	R	27.8	18.5	0:04.33 mem2.bash
1	root	20	0	179188	4840	3492	S	0.0	0.3	0:02.46 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp

```

Iteration 9
MiB Mem : 1826.8 total,      856.7 free,      837.4 used,      132.7 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      849.8 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1702 root        20   0 612020 392588  2916 R  41.2  21.0   0:04.91 mem.bash
 1703 root        20   0 602912 383344  2920 R  35.3  20.5   0:04.91 mem2.bash
 1676 root        20   0        0        0        0 I   5.9   0.0   0:05.02 kworker/0:0-events
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd

```

```

Iteration 10
MiB Mem : 1826.8 total,      760.4 free,      933.7 used,      132.7 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      753.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1702 root        20   0 661916 442484  2916 R  46.7  23.7   0:05.51 mem.bash
 1703 root        20   0 650036 430600  2920 R  33.3  23.0   0:05.49 mem2.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 11
MiB Mem : 1826.8 total,      665.6 free,     1028.4 used,      132.7 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      658.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1703 root        20   0 699536 479968  2920 R  40.0  25.7   0:06.09 mem2.bash
 1702 root        20   0 712208 492644  2916 R  35.0  26.3   0:06.10 mem.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 12
MiB Mem : 1826.8 total,      569.1 free,     1125.0 used,      132.7 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      562.1 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1702 root        20   0 761312 541748  2916 R  36.8  29.0   0:06.68 mem2.bash
 1703 root        20   0 748508 529072  2920 R  36.8  28.3   0:06.69 mem.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 13
MiB Mem : 1826.8 total,      467.5 free,     1226.6 used,      132.7 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      460.5 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1703 root        20   0 799196 579760  2920 R  36.8  31.0   0:07.29 mem2.bash
 1702 root        20   0 813848 594284  2916 R  31.6  31.8   0:07.29 mem.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 14
MiB Mem : 1826.8 total,      370.6 free,     1323.5 used,      132.8 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      363.7 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1703 root        20   0 848036 628600  2920 R  37.5  33.6   0:07.87 mem2.bash
 1702 root        20   0 862292 642860  2916 R  31.2  34.4   0:07.86 mem.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 15
MiB Mem : 1826.8 total,      275.3 free,     1418.7 used,      132.8 buff/cache
MiB Swap:  820.0 total,      735.3 free,      84.7 used.      268.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 1703 root        20   0 896216 676648  2920 R  46.7  36.2   0:08.46 mem2.bash
 1702 root        20   0 911132 691700  2916 R  33.3  37.0   0:08.45 mem.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0        0        0        0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20        0        0        0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 16
MiB Mem : 1826.8 total, 179.2 free, 1514.8 used, 132.8 buff/cache
MiB Swap: 820.0 total, 735.3 free, 84.7 used, 172.3 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1702 root        20   0 961160 741860 2916 R  38.9  39.7   0:09.05 mem2.bash
 1703 root        20   0 945716 726280 2920 R  38.9  38.8   0:09.05 mem2.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 17
MiB Mem : 1826.8 total, 80.2 free, 1613.8 used, 132.8 buff/cache
MiB Swap: 820.0 total, 735.3 free, 84.7 used, 73.3 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 996008 776440 2920 R  41.2  41.5   0:09.65 mem2.bash
 1702 root        20   0 1011848 792284 2916 R  35.3  42.4   0:09.65 mem2.bash
    1 root        20   0 179188  4840  3492 S   0.0   0.3   0:02.46 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp

```

```

Iteration 18
MiB Mem : 1826.8 total, 689.6 free, 1087.6 used, 49.7 buff/cache
MiB Swap: 820.0 total, 374.9 free, 445.1 used, 641.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 1759232  1.1g  1668 R  72.2  62.8   0:19.15 mem2.bash
    1 root        20   0 179188  2668  2404 S   0.0   0.1   0:02.47 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

```

```

Iteration 19
MiB Mem : 1826.8 total, 431.2 free, 1342.8 used, 52.8 buff/cache
MiB Swap: 820.0 total, 375.5 free, 444.5 used, 384.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 1857572  1.2g  1668 R  82.4  68.1   0:20.33 mem2.bash
    1 root        20   0 179188  2668  2404 S   0.0   0.1   0:02.47 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

```

```

Iteration 20
MiB Mem : 1826.8 total, 339.2 free, 1434.7 used, 52.8 buff/cache
MiB Swap: 820.0 total, 375.5 free, 444.5 used, 292.4 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 1951556  1.3g  1668 R  68.4  73.1   0:21.46 mem2.bash
    1 root        20   0 179188  2668  2404 S   0.0   0.1   0:02.47 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

```

```

Iteration 21
MiB Mem : 1826.8 total, 244.8 free, 1529.1 used, 52.8 buff/cache
MiB Swap: 820.0 total, 375.5 free, 444.5 used, 198.0 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 2047652  1.4g  1668 R  73.7  78.2   0:22.62 mem2.bash
    1 root        20   0 179188  2668  2404 S   0.0   0.1   0:02.47 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

```

```

Iteration 22
MiB Mem : 1826.8 total, 152.8 free, 1620.1 used, 53.8 buff/cache
MiB Swap: 820.0 total, 375.7 free, 444.3 used, 106.5 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 1703 root        20   0 2138864  1.5g  1668 R  75.0  83.1   0:23.70 mem2.bash
    1 root        20   0 179188  2668  2404 S   0.0   0.1   0:02.47 systemd
    2 root        20   0      0      0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I   0.0   0.0   0:00.00 rcu_par_gp

```

```
Iteration 23
MiB Mem : 1826.8 total, 129.5 free, 1643.2 used, 54.1 buff/cache
MiB Swap: 820.0 total, 375.8 free, 444.2 used, 17.1 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
 3786 root        20   0 2264812    1.6g  1924 R   65.0   84.5   0:23.17 mem2.bash
    1 root        20   0 179188      0    2480 S    0.0    0.1   0:03.25 systemd
    2 root        20   0      0      0      0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I    0.0    0.0   0:00.00 rcu_par_gp
```

```
Iteration 24
MiB Mem : 1826.8 total, 1680.8 free, 94.5 used, 51.5 buff/cache
MiB Swap: 820.0 total, 516.9 free, 303.1 used, 1633.3 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM    TIME+  COMMAND
    1 root        20   0 179188    1872   1580 S    0.0    0.1   0:03.32 systemd
    2 root        20   0      0      0      0 S    0.0    0.0   0:00.00 kthreadd
    3 root         0 -20      0      0      0 I    0.0    0.0   0:00.00 rcu_gp
    4 root         0 -20      0      0      0 I    0.0    0.0   0:00.00 rcu_par_gp
    6 root         0 -20      0      0      0 I    0.0    0.0   0:00.00 kworker/0:0H-kblockd
```

Последние записи о скриптах в системном журнале

```
[ 3024.241510] [ 1702]      0 1702 359585 208236 2519040 95762      0 mem.bash
[ 3024.241754] [ 1703]      0 1703 352721 206363 2461696 90779      0 mem2.bash
[ 3024.242750] Out of memory: Killed process 1702 (mem.bash) total-vm:1438340kB, anon-rss:832944kB,
file-rss:0kB, shmem-rss:0kB, UID:0
[ 3024.323405] oom_reaper: reaped process 1702 (mem.bash), now anon-rss:0kB, file-rss:0kB, shmem-rss:0kB
[ 3062.618399] [ 1703]      0 1703 648599 406410 4833280 186629      0 mem2.bash
[ 3062.619633] Out of memory: Killed process 1703 (mem2.bash) total-vm:2594396kB, anon-rss:1625580kB,
file-rss:60kB, shmem-rss:0kB, UID:0
[ 3062.742467] oom_reaper: reaped process 1703 (mem2.bash), now anon-rss:0kB, file-rss:0kB, shmem-rs
s:0kB
```

Последняя строка файла report.log

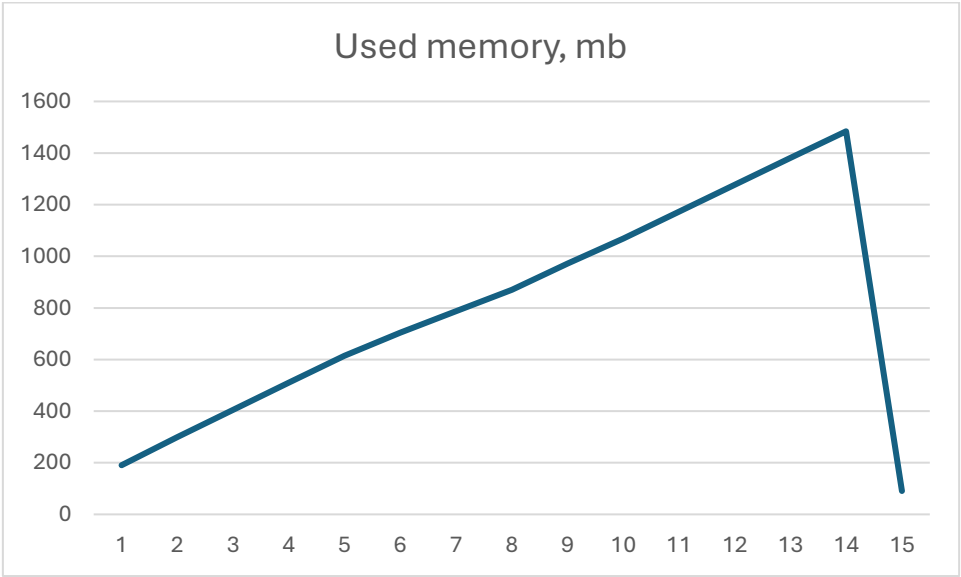
```
Array size is 15000000
```

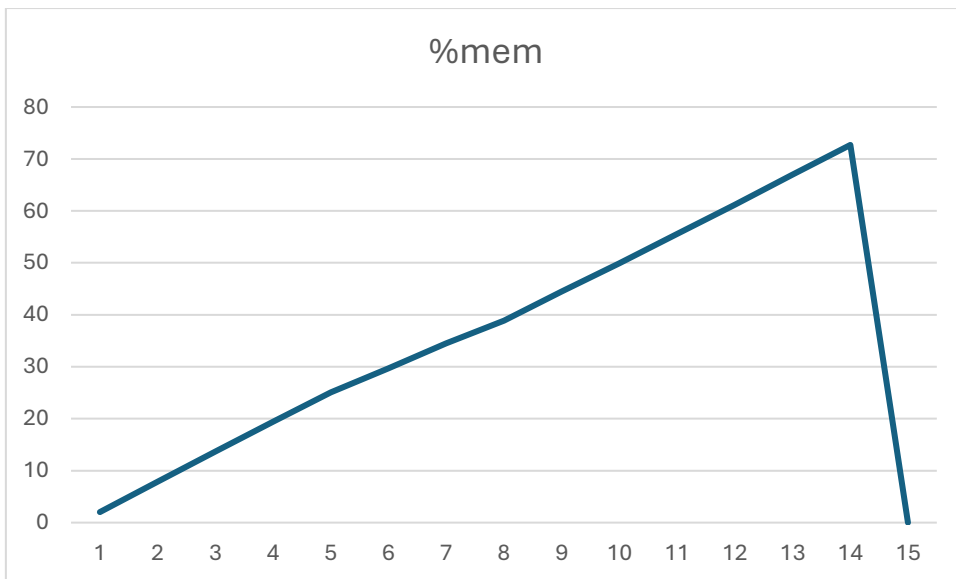
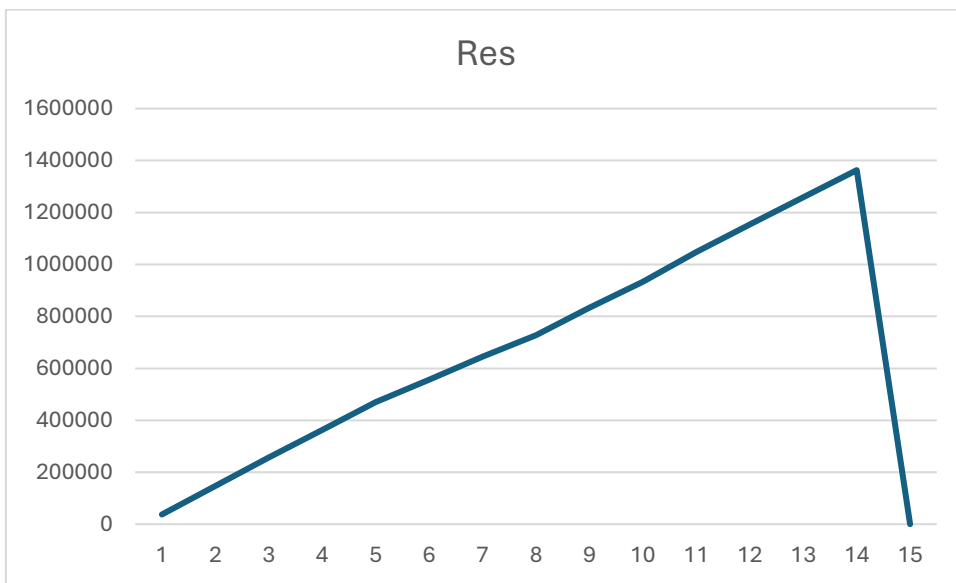
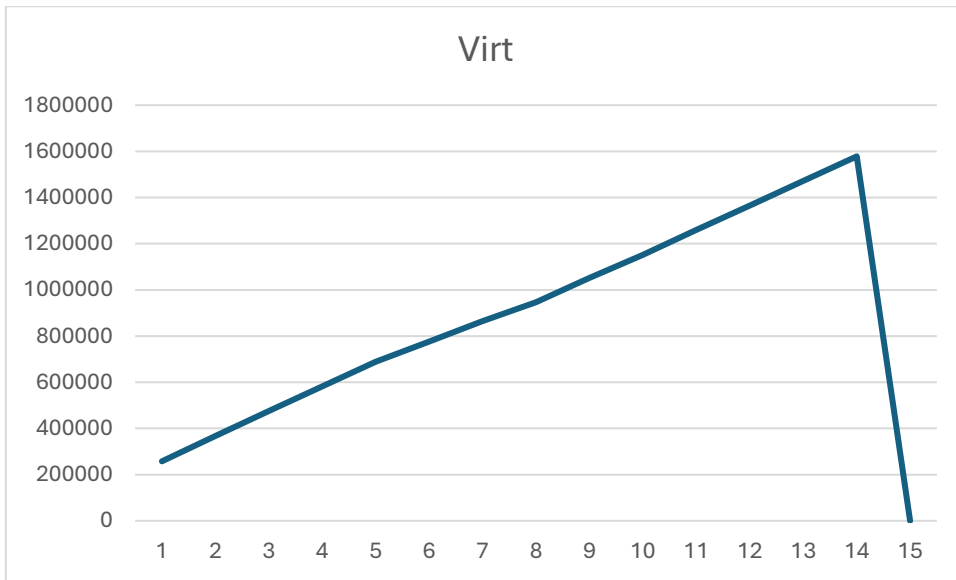
Последняя строка файла report2.log

```
Array size is 30000000
```

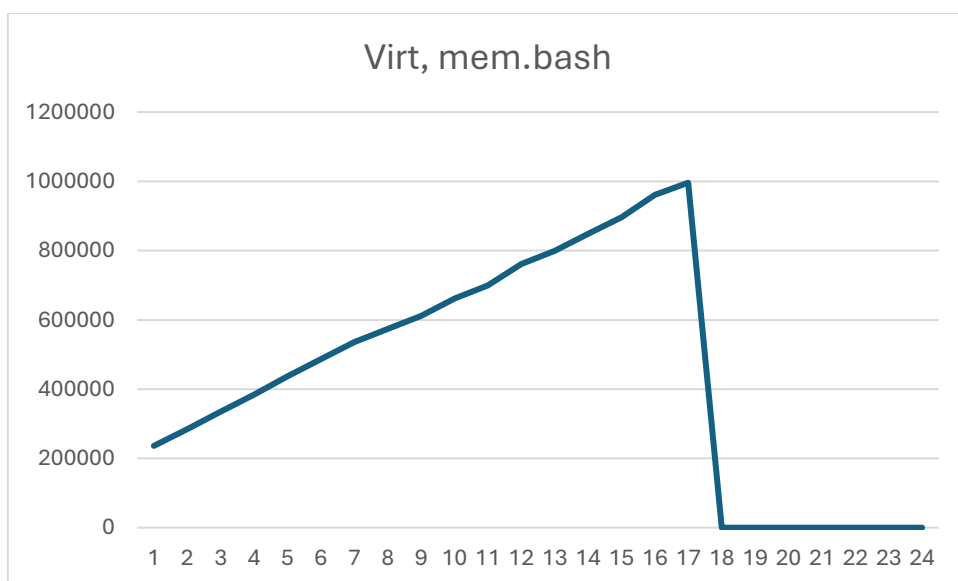
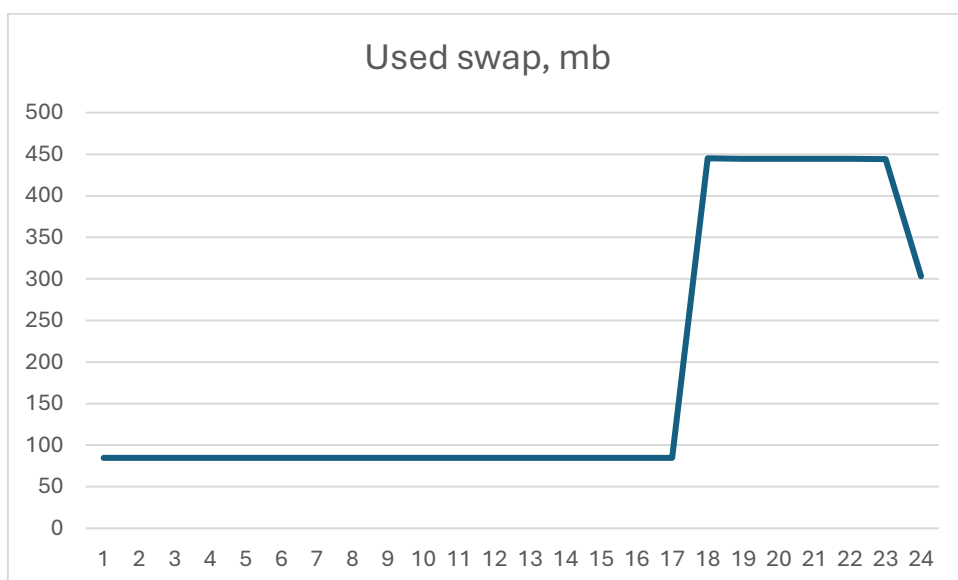
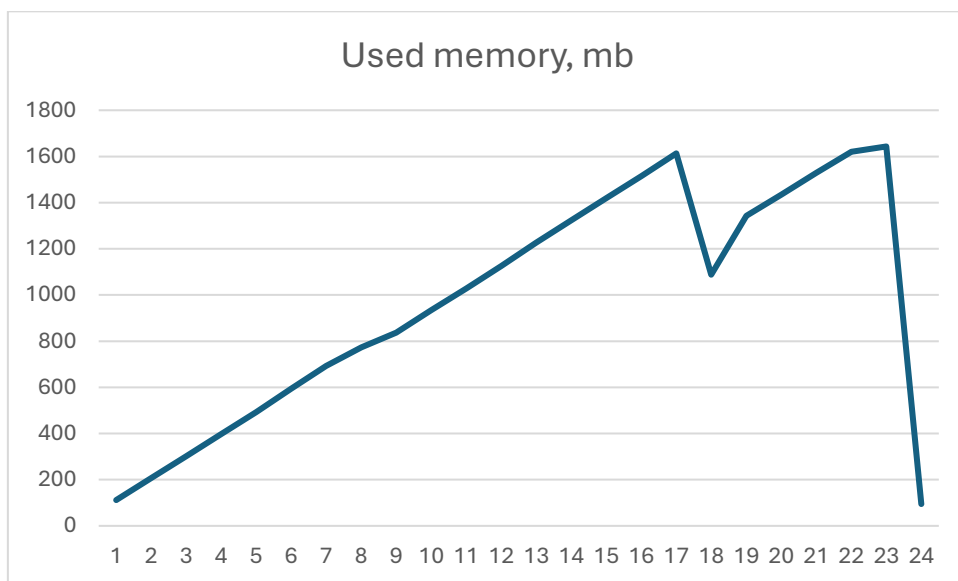
Обработка результатов

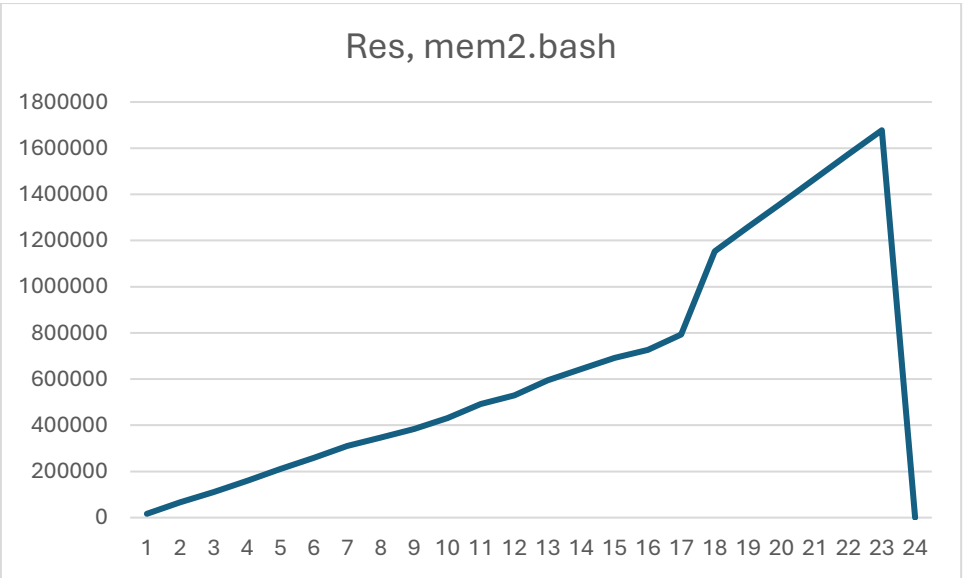
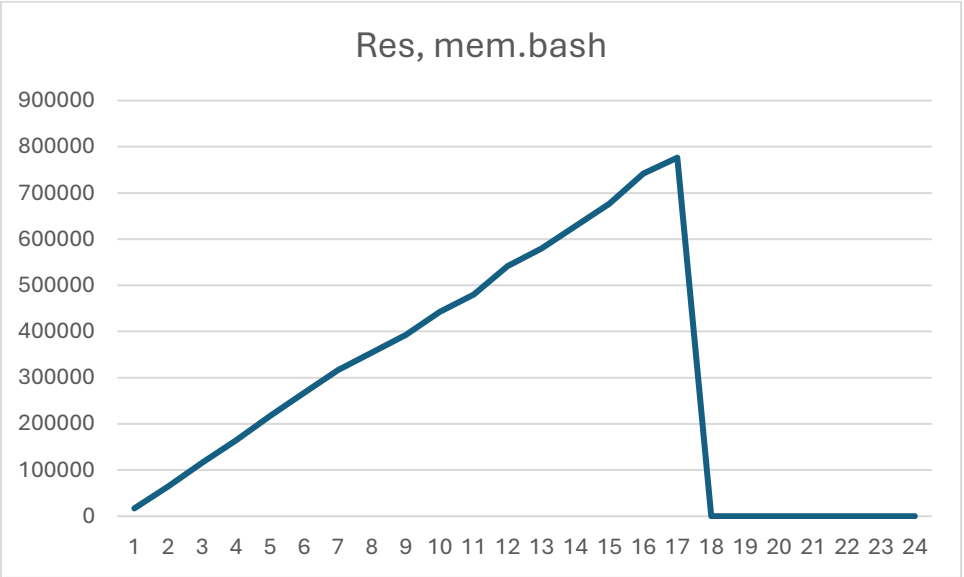
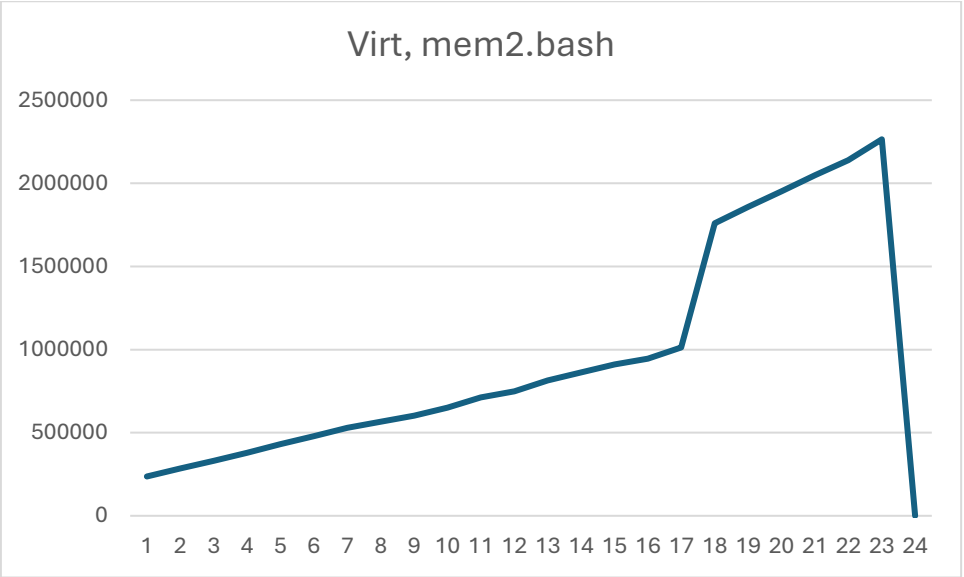
Первый этап

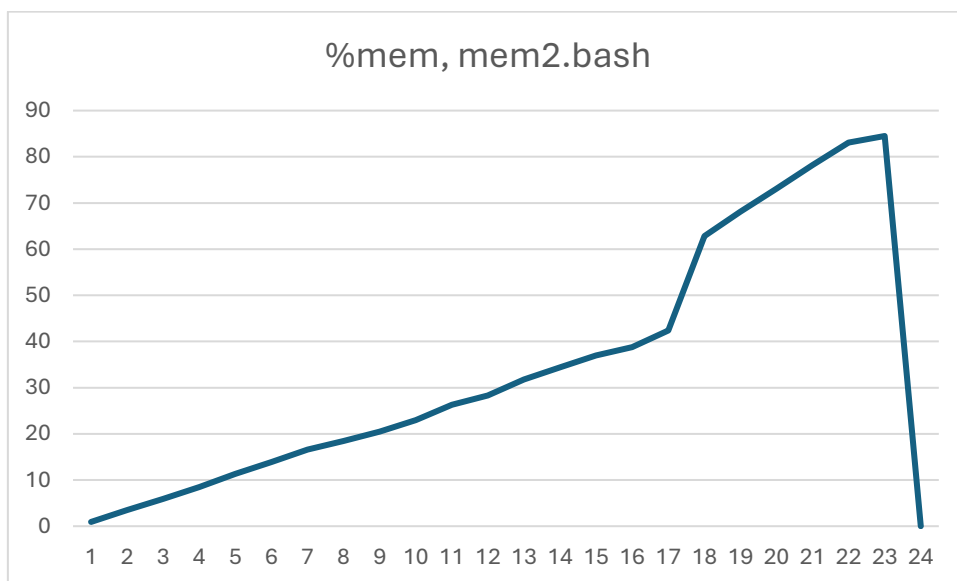
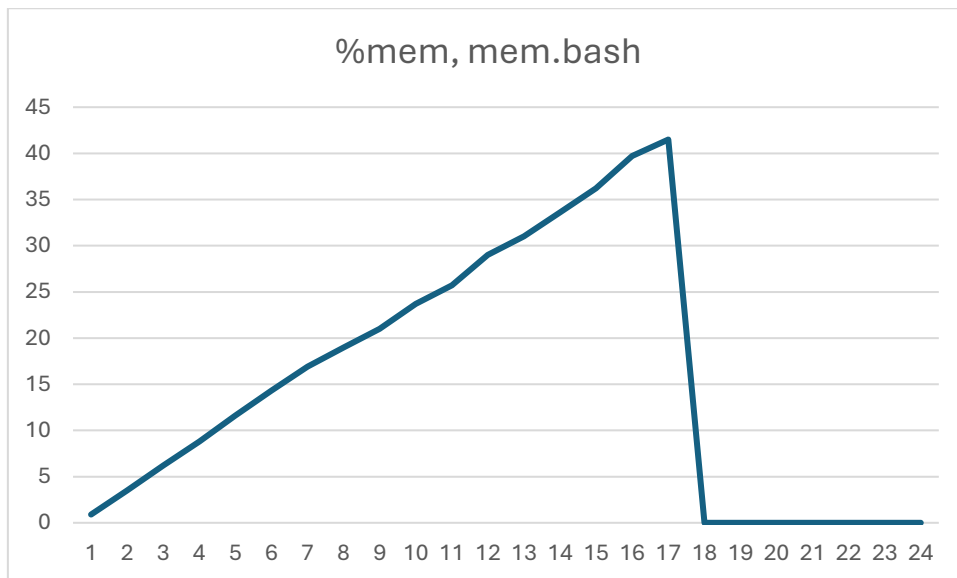




Второй этап







Эксперимент 2

Подготовительный этап:

Копия скрипта mem.bash newmem.bash, завершает работу, как только размер создаваемого массива превышает значение N, передаваемое в качестве параметра скрипту

```
#!/bin/bash
N=$1
> report.log
array=()
step=0
while true; do
array+=((1..10))
step=$((step + 1))
if [ ${#array[@]} -gt $N ]; then
echo "Array size exceeded $N elements"
exit 0
fi
done
```

Основной этап:

Скрипт, который запускает newmem.bash каждую секунду, всего K запусков

```
#!/bin/bash
N=$1
K=$2

for ((i = 1; i <= K; i++)); do
    ./newmem.bash $N &
    sleep 1
done
wait
```

```
[root@localhost lab5]# ./task2.bash 3000000 10
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
Array size exceeded 3000000 elements
[root@localhost lab5]#
```

```
[root@localhost lab5]# dmesg | grep "newmem.bash"
[root@localhost lab5]#
```

Максимальное значение N: 1829658