

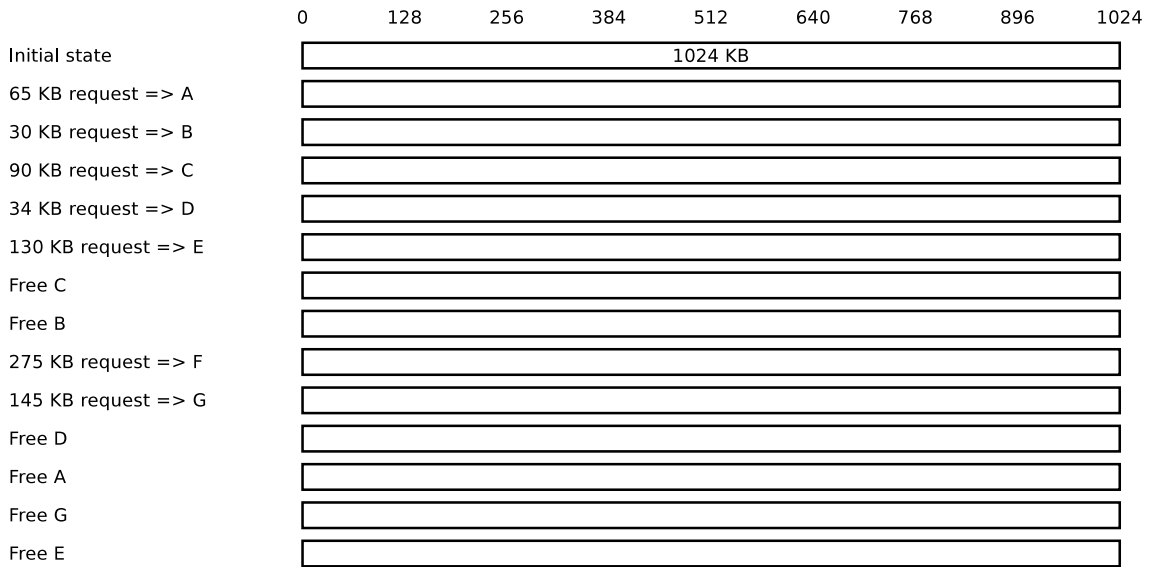
Exercise Sheet 5

Exercise 1 (Memory Management)

1. With which memory management methods do internal fragmentation occur?
 - Static partitioning
 - Dynamic partitioning
 - Buddy memory allocation
2. With which memory management methods do external fragmentation occur?
 - Static partitioning
 - Dynamic partitioning
 - Buddy memory allocation
3. How can external fragmentation be fixed?
4. Which memory management method searches for the block, which fits best?
 - First Fit
 - Next Fit
 - Best fit
 - Random
5. Which memory management concept searches for a free block, starting from the beginning of the address space?
 - First Fit
 - Next Fit
 - Best fit
 - Random
6. Which memory management concept fragments quickly the large area of free space at the end of the address space?
 - First Fit
 - Next Fit
 - Best fit
 - Random
7. Which memory management concept selects random a free and appropriate block?
 - First Fit
 - Next Fit
 - Best fit
 - Random
8. Which memory management concept searches for a free block, starting from the latest allocation?
 - First Fit
 - Next Fit
 - Best fit
 - Random
9. Which memory management concept produces many mini-fragments and is slow?
 - First Fit
 - Next Fit
 - Best fit
 - Random

Exercise 2 (Buddy Memory Allocation)

The Buddy method for allocating memory to processes shall be used for a memory with a capacity of 1024 kB. Perform the provided operations and give the occupancy state of the memory after each operation.



Exercise 3 (Real Mode and Protected Mode)

1. Describe the functioning of the real mode.
2. Why is it impossible to use real mode for multitasking operation mode?
3. Describe the functioning of the protected mode.
4. What is virtual memory?
5. Explain, why virtual memory helps to better utilize the main memory.
6. What is mapping?
7. What is swapping?
8. Which component of the CPU is used to implement virtual memory?
9. Describe the function of the component from subtask 8.
10. Name the two different virtual memory concepts.
11. What are the differences between the concepts of subtask 10?
12. With which concept of subtask 10 does internal fragmentation occur?

13. With which concept of subtask 10 does external fragmentation occur?
14. What causes a page fault exception to occur?
15. What is the reaction of the operating system, when a page fault exception occurs?
16. What causes an access violation exception or general protection fault exception to occur?
17. What is the consequence (effect) of an access violation exception or general protection fault exception?
18. What contains the kernelspace?
19. What contains the userspace?

Exercise 4 (Memory Management)

Please mark for each one of the following statements, whether the statement is true or false.

1. Real mode is suited for multitasking systems.
 True False
2. When protected mode is executed in its own copy of the physical address space, which is protected from other processes
 True False
3. When static partitioning is used, internal fragmentation occurs.
 True False
4. When dynamic partitioning is used, external fragmentation cannot occur.
 True False
5. When segmentation is used, the operating system maintains a segment table for each process.
 True False
6. Internal fragmentation cannot occur with segmentation.
 True False
7. External fragmentation cannot occur with segmentation.

- True False
8. With paging, all pages have the same length.
- True False
9. With segmentation, the segments are of different lengths.
- True False
10. Modern operating systems use only segmentation.
- True False
11. One advantage of long pages is little internal fragmentation.
- True False
12. A drawback of short page page table can become huge.
- True False
13. When paging is used, translates the MMU the logical memory addresses into into physical memory addresses.
- True False
14. Modern operating systems (for x86) operate in real mode and use only segmenting.
- True False
15. Modern operating systems (for x86) operate in protected mode and use only paging.
- True False

Exercise 5 (Page Replacement Strategies)

1. Why is it impossible to implement the optimal replacement strategy OPT?
2. Perform the access sequence with the replacement strategies Optimal, LRU, LFU and FIFO once with a cache with a capacity of 4 pages and once with 5 pages. Also calculate the hit rate and the miss rate for all scenarios.

Optimal replacement strategy (OPT):

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							

Hit rate:
 Miss rate:

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							
Page 5:																							

Hit rate:
 Miss rate:

Replacement strategy Least Recently Used (LRU):

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							

Hit rate:
 Miss rate:

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							
Page 5:																							

Hit rate:
 Miss rate:

Replacement strategy Least Frequently Used (LFU):

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							

Hit rate:
 Miss rate:

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							
Page 5:																							

Hit rate:
 Miss rate:

Replacement strategy FIFO:

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							

Hit rate:
 Miss rate:

Requests: **1 3 5 4 2 4 3 2 1 0 5 3 5 0 4 3 5 4 3 2 1 3 4 5**

Page 1:																							
Page 2:																							
Page 3:																							
Page 4:																							
Page 5:																							

Hit rate:
 Miss rate:

3. What is the key message of Laszlo Belady's anomaly?

4. Show Belady's anomaly by performing the access sequence with the replacement strategy FIFO once with a cache with a capacity of 3 pages and once with 4 pages. Also calculate the hit rate and the miss rate for both scenarios.

Requests: **3 2 1 0 3 2 4 3 2 1 0 4**

Page 1:											
Page 2:											
Page 3:											

Hit rate:

Miss rate:

Requests: **3 2 1 0 3 2 4 3 2 1 0 4**

Page 1:											
Page 2:											
Page 3:											
Page 4:											

Hit rate:

Miss rate:

Show Belady's anomaly by performing the access sequence with the replacement strategy FIFO once with a cache with a capacity of 3 pages and once with 4 pages.

5. Calculate for both scenarios of subtask 4 the hit rate and miss rate.

Exercise 6 (Time-based Command Execution, Sorting, Environment Variables)

1. Create in your home directory a directory `NotImportant` and write a cron job, which erases the content of the directory `NotImportant` every Tuesday at 1:25 clock am.

The output of the command should be appended to a file `EraseLog.txt` in your home directory.

2. Write a cron job, which appends a line at a file `Datum.txt` with the following format (but with the current values) every 3 minutes between 14:00 to 15:00 clock on every Tuesday in the month of November:

```
Heute ist der 30.10.2008
Die Uhrzeit ist 09:24:42 Uhr
*****
```

3. Write an at-job, which outputs at 17:23 today a list of the running processes.
4. Write an at-job, which outputs at December 24th at 8:15 am the text „It’s christmas!“
5. Create in your home directory a file `Kanzler.txt` with the following content:

```
Willy      Brandt    1969
Angela     Merkel   2005
Gerhard    Schröder 1998
KurtGeorg Kiesinger 1966
Helmut     Kohl     1982
Konrad     Adenauer 1949
Helmut     Schmidt  1974
Ludwig     Erhard   1963
```

6. Print out the file `Kanzler.txt` sorted by the first names.
7. Print out the file `Kanzler.txt` sorted by the third letter of the last names.
8. Print out the file `Kanzler.txt` sorted by the year of the inauguration.
9. Print out the file `Kanzler.txt` backward reverse sorted by the year of the inauguration and redirect the output into a file `Kanzlerdaten.txt`.
10. Create with the command `export` an environment variable `VAR1` and assign it the value `Testvariable`.
11. Print out the value of `VAR1` in the shell.
12. Erase the environment variable `VAR1`.