# Heimadæmi 4

T-444-USTY, GRUNNATRIÐI STÝRIKERFA

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March 25, 2017

# Chapter 9

**Review Question 9.2.** What is the main function of a dispatcher? Give some examples of events when it is invoked.
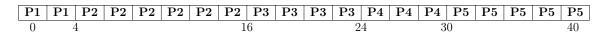
**Solution:**

It is the module that gives control of the CPU to the process selected by the short-time scheduler, which involves switching context, and to user mode.

**Problem 9.1.** Given the following jobs that are to be processed on a single processor:

| Process | Burst Time in ms | Arrival Time in ms |
|---------|------------------|--------------------|
| P1 | 4 | 0 |
| P2 | 12 | 2 |
| P3 | 8 | 6 |
| P4 | 6 | 16 |
| P5 | 10 | 20 |

**a**. Show the schedule using the scheduling algorithms shortest process next, a non-preemptive algorithm, and shortest remaining time, a preemptive algorithm. Use a GANTT chart to show the schedules in a manner similar to the FCFS schedule shown below: (1 unit = 2 ms)

| P1 | P1 | P2 | P2 | P2 | P2 | P2 | P2 | P3 | P3 | P3 | P3 | P4 | P4 | P4 | P5 | P5 | P5 | P5 | P5 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

0     4                       16               24           30                   40

SPN:

| P1 | P1 | P4 | P4 | P4 | P3 | P3 | P3 | P3 | P5 | P5 | P5 | P5 | P5 | P2 | P2 | P2 | P2 | P2 | P2 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

0     4           10              18                  28                         40

SRT:

| P1 | P1 | P2 | P3 | P3 | P3 | P3 | P2 | P4 | P4 | P4 | P2 | P2 | P2 | P2 | P5 | P5 | P5 | P5 | P5 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

0     4     6           14    16          22                30                   40

**b**. Compute the turnaround time and relative delay for each algorithm

**Solution:**

Turnaround time:

SPN: $4 + 12 + 8 + 6 + 10 = 40/5 = 8$

SRT: $(4-0)+(30-2)+(14-6)+(22-16)+(40-20) = 4+28+8+6+20 = 66/5 = 13.2$

Relative Delay:

SPN: $1 + 1 + 1 + 1 + 1 = 5/5 = 1$

SRT: $4/4 + 28/12 + 8/8 + 6/6 + 20/10 = 1 + 2.333 + 1 + 1 + 2 = 7.333/5 = 1.46$

**Problem 9.2.** What factors determine the time quantum in round robin scheduling? Consider the system:

| Process | Arrival Time in ms | Processing Time in ms |
|---------|--------------------|-----------------------|
| P1      | 0                  | 12                    |
| P2      | 2                  | 6                     |
| P3      | 8                  | 18                    |
| P4      | 10                 | 4                     |

Context switch takes a time of 1 unit. Compute the average turnaround time of the processes for the time quanta $q = 2$, $q = 4$ and $q = 8$ respectively.

**Solution:**
Turnaround time:
$q = 2$: $(45 - 0) + (27 - 2) + (54 - 8) + (21 - 10) = 45 + 25 + 46 + 11 = 127/4 = 31.75$
$q = 4$: $(37 - 0) + (27 - 2) + (48 - 8) + (19 - 10) = 37 + 25 + 40 + 9 = 111/4 = 27.75$
$q = 8$: $(33 - 0) + (15 - 2) + (44 - 8) + (28 - 10) = 33 + 13 + 36 + 18 = 100/4 = 25$
By increasing the quantum there is less overhead for each context switch so there is less total time, and the average turnaround time is less.

# Chapter 10

**Review Question 10.1.** List and briefly define five different categories of synchronization granularity.
**Solution:**
Independent: Multiple unrelated processes.
Fine grained: Parallelism inherent in a single instruction stream.
Medium grained: Parallel processing or multitasking within a single application.
Coarse grained: A multiprogramming environment where processes are split into large sized tasks.
Very Coarse grained: Distributed processing across network nodes to form a single computing environment.

**Review Question 10.2.** What grain size of parallelism is appropriate for a multi-programmed uniprocessor?
**Solution:**
Medium grained parallelism.

**Review Question 10.3.** For which kinds of applications is gang scheduling of threads most useful?

**Solution:**
For applications that can have a set of related threads that can be scheduled to run on a set of processors at the same time, on a one-to-one basis.

## Chapter 11

**Review Question 11.4.** Why would you expect improved performance using a double buffer rather than a single buffer for I/O?
**Solution:**
A double buffer means that OS doesn't have to wait for I/O so it can transfer data from one buffer while the other one is being filled.

**Problem 11.3.** Consider a disk drive with 4000 cylinders, numbered from 0 to 3999. The request queue has the following composition:

| 1045 | 750 | 932 | 878 | 1365 | 1787 | 1245 | 664 | 1678 | 1897 |
|------|-----|-----|-----|------|------|------|-----|------|------|

If the current positions is 1167 and the previous request was served at 1250, compute the total distance (in cylinders) that the disk arm would move for each of the following algorithms:

a: FIFO

b: SSTF

c: SCAN

d: C-SCAN

**Solution:**
FIFO: 143 + 86 + 1470 + 913 + 1774 + 948 + 1509 + 1022 + 1750 + 130 = 7081. So seek distance is 7081.
SSTF: 143 + 130 + 86 + 913 + 948 + 1022 + 1470 + 1509 + 1750 + 1774 = 1745. So seek distance is 1745.
SCAN: 143 + 913 + 948 + 1022 + 1470 + 1509 + 1750 + 1774 + 4999 + 130 + 86. So seek distance is 9769.
C-SCAN: 143 + 913 + 948 + 1022 + 1470 + 1509 + 1750 + 1774 + 4999 + 0 + 86 + 130. So seek distance is 9985.

# Chapter 12

**Problem 12.1.** A file contains 20000 records, each of a fixed size of 140 bytes. The file is to be stored in a disk drive having blocks of 3096 bytes with 512 bytes of inter-block gaps. If unspanned blocking is used, compute the following:

    **a**. Blocking factor (i.e., the average number of blocks per record).

    **b**. Number of blocks needed to store the 30000 records.

    **c**. Total size of the file.

**Solution:**
a) $3096/140 = 22.11$, so 22 records per block. Blocking factor is 22.
b) $3000/22 = 136.36$, so 137 blocks.
c) $2000/22 = 90.9$, so 91 blocks. $3096 * 91 + 512*90 = 327816$ bytes.

**Problem 12.4.** For the B-tree in Figure 12.4c, show the result of inserting the key 97.

**Solution:**
The right branch will split into two, [73, 85] and [90, 96, 97]. The 88 will be moved to the root [23, 39, 51, 61, 71] which will then be split into two [23, 39] and [61, 71, 88]. Then 51 will be moved to be a new root node [51].

**Problem 12.7.** A sequential file is stored in a disk occupying 100 contiguous disk blocks. The disk has an average rotational delay of 2.5 ms. The time taken to seek the head of the drive to the required cylinder is 25 ms and the time taken to read a block is 0.25 ms. Find the minimum, maximum, and average time to search for a record using a linear search process.
**Solution:**
Minimum: $25 + (2.5 + 0.25)*1$ (the number of blocks in the best case) $= 27.75$ms
Average: $25 + (2.5 + 0.25)*50$ (the number of blocks in the best case) $= 162.5$ms
Maximum: $25 + (2.5 + 0.25)*100$ (the number of blocks in the best case) $= 300$ms