Task 1: Real-time Systems concept

What are the main differences between the fast computing and the real-time computing? Think of some critical applications which require a real-time system support. What are the most important features requested? In which situations, instead, would a fast-computing system do?
Task 2: Non-RT Scheduling

Given is a set of independent tasks $T_1, \cdots, T_6$ with execution times and arrival times shown in the following table.

<table>
<thead>
<tr>
<th>$a_i$ [m.s]</th>
<th>$T_1$</th>
<th>$T_2$</th>
<th>$T_3$</th>
<th>$T_4$</th>
<th>$T_5$</th>
<th>$T_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>5</td>
<td>20</td>
<td>50</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>20</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Determine the schedules generated by following algorithms:

a) FCFS (first come first served)

b) SJF (shortest job first)

c) SRTN (shortest remaining time next)

d) preemptive scheduling with fixed priorities 2, 1, 4, 3, 6, 7 for tasks $T_1, T_2, \cdots, T_6$ (1 is the highest priority)

e) RR (round-robin) with a time slice duration of 2.5 m.s.

Compare the schedules according to the parameters i) processor utilization, ii) average response time and iii) average waiting time.
Task 3: Design of a Real-time System

For the real-time system scheduling, it is important to know the running time of each task \textit{a priori}. What are the difficulties encountered in a design of a scheduling algorithm for a real-time system. What are the possible solutions? How can we compare different scheduling algorithms?
**Task 4: Scheduling Function**

A real-time system had to execute four tasks $J_1, J_2, J_3, J_4$ with arrival times and deadlines shown in the following table. The scheduling function $\sigma(t)$ observed is shown in Figure 1.

<table>
<thead>
<tr>
<th></th>
<th>$J_1$</th>
<th>$J_2$</th>
<th>$J_3$</th>
<th>$J_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>arrival time</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>deadline</td>
<td>10</td>
<td>10</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

![Figure 1: Scheduling Function](image_url)

Determine

a) the maximum lateness,

b) the tasks’ laxities, and

c) the processor utilization for this schedule.

Is the schedule feasible? If not, try to modify the scheduling function so that the schedule becomes feasible.