



Process Scheduling



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Home Day Week Month Horizon Resource Share

Today Resource (1 of 1) Refresh

	Sunday, 12	Monday, 13	Tuesday, 14	Wednesday, 15
All Day	Reset the...	Meeting w...	Send a QA ...	Meeting I ...
6:00am - 30	6:15am - Maecena Phyllis	6:00am - 12 Closure of FRT Josh Davis GenePoint	6:00am - 8:30 Site Assessment Josh Davis Edge Communicat	6:00am - 8:00 Call with Jim Jake Llorac
7:00am - 30	7:45am - 10:30 Complete roofing & wiring for FRT Dickenson	7:30a Begin Collec Feed Babar Levy Overl		8:00 Call to f on bid Duck
8:00am - 30				
9:00am - 30				
10:00am - 30			9:45am - 2:4 Maecenas Phyllis Cotton London, UK	
11:00am - 30		10:45am - 2: Maecenas Phyllis Cotton London, UK		11:00am - 4 Meet about the CRL Project Avi Green Edge Installation
12:00pm - 30	12:15pm Install RPL	12:15pm - 3: Demo to PJ and Terry Dickenson pic We spoke	12:30pm - 5 Vist options for Davidson (805) 258-9985 x45	12:45pm - 2 Pitch video
1:00pm - 30				
2:00pm - 30				
3:00pm - 30				
4:00pm - 30				
5:00pm - 30				10:00am - 2 Work on proposal Josh Davis GenWatt Gasoline 300kW miami, fl

Resource: 3, Days: 4



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COURSE NAME : 23CST202 – OPERATING SYSTEMS

II YEAR/ IV SEMESTER

UNIT – II PROCESS SCHEDULING AND SYNCHRONIZATION

Topic: CPU Scheduling – FCFS, SJF

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Department of Computer Science and Engineering



Outline



➤ **Why Operating System in this semester**

Empathize

➤ **Why Scheduling**

➤ **Scheduling Criteria**

➤ **Scheduling Algorithm Optimization Criteria**

Define

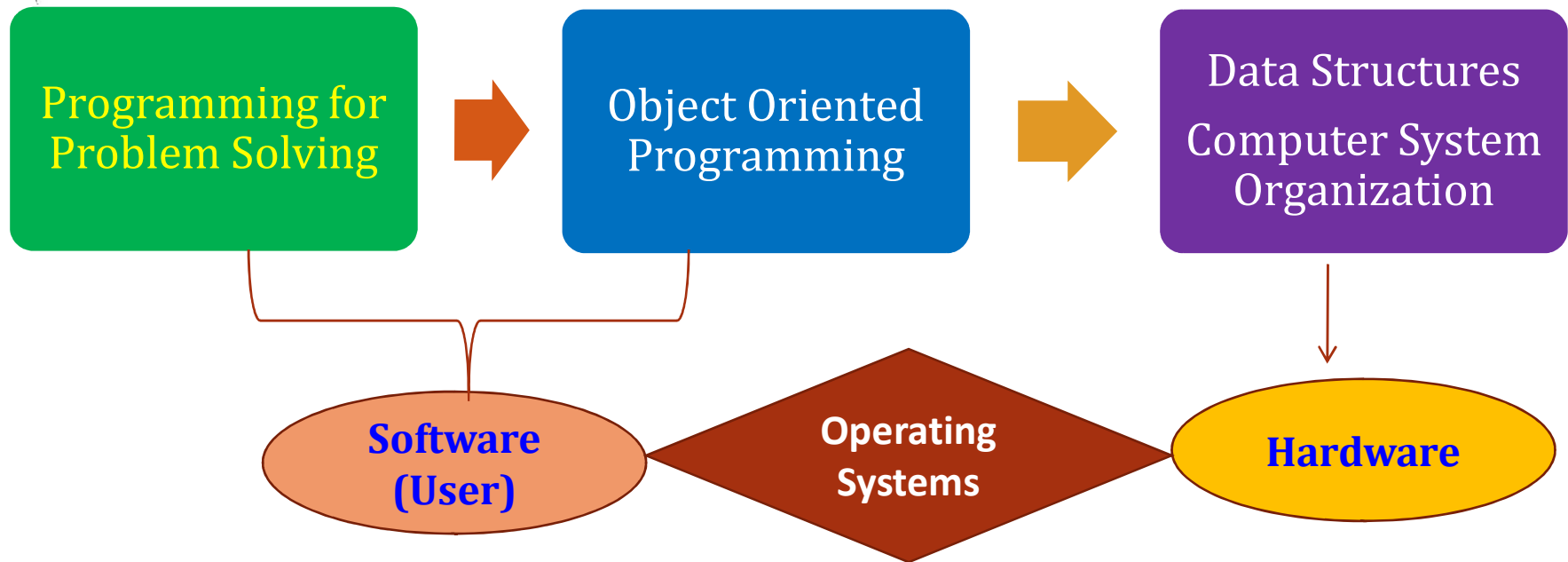
➤ **First- Come, First-Served (FCFS) Scheduling**

➤ **Shortest Job First (SJF) Scheduling**

Ideate



Why Operating System in this Semester?





Scheduling Criteria

- **CPU utilization** – keep the CPU as busy as possible
- **Throughput** – # of processes that complete their execution per time unit
- **Turnaround time** – amount of time to execute a particular process
- **Waiting time** – amount of time a process has been waiting in the ready queue
- **Response time** – amount of time it takes from when a request was submitted until the first response is produced, not output (for time-sharing environment)



Scheduling Algorithm Optimization Criteria



- Max CPU utilization
- Max throughput
- Min turnaround time
- Min waiting time
- Min response time



First- Come, First-Served (FCFS) Scheduling



<u>Process</u>	<u>Burst Time</u>
P_1	24
P_2	3
P_3	3

- Suppose that the processes arrive in the order: P_1 , P_2 , P_3
The Gantt Chart for the schedule is:



- Waiting time for $P_1 = 0$; $P_2 = 24$; $P_3 = 27$
- Average waiting time: $(0 + 24 + 27)/3 = 17$



FCFS Scheduling (Cont.)



Suppose that the processes arrive in the order:

$$P_2, P_3, P_1$$

- The Gantt chart for the schedule is:



- Waiting time for $P_1 = 6$; $P_2 = 0$; $P_3 = 3$
- Average waiting time: $(6 + 0 + 3)/3 = 3$
- Much better than previous case
- **Convoy effect** - short process behind long process
 - Consider one CPU-bound and many I/O-bound processes



Shortest-Job-First (SJF) Scheduling



- Associate with each process the length of its next CPU burst
 - Use these lengths to schedule the process with the shortest time
- SJF is optimal – gives **minimum average waiting time** for a given set of processes
 - The difficulty is knowing the length of the next CPU request

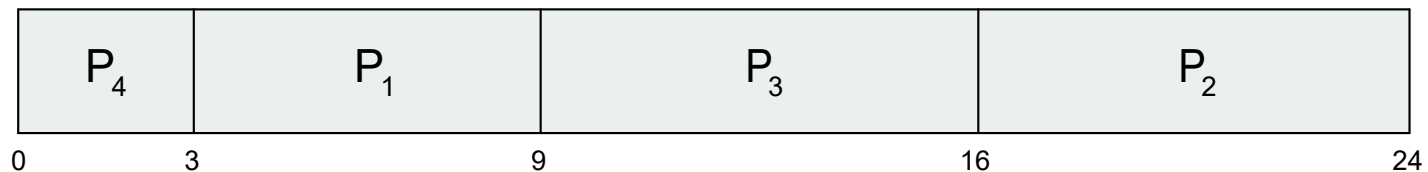


Example of SJF



<u>Process</u>	<u>Burst Time</u>
P_1	6
P_2	8
P_3	7
P_4	3

- SJF scheduling chart



- Average waiting time = $(3 + 16 + 9 + 0) / 4 = 7$



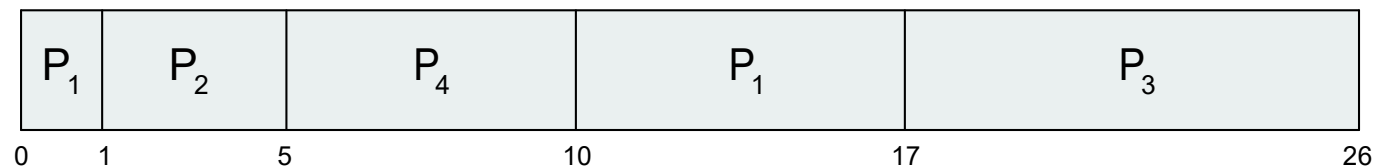
Example of Shortest-remaining-time-first



- Now we add the concepts of varying arrival times and preemption to the analysis

<u>Process</u>	<u>Arrival Time</u>	<u>Burst Time</u>
P_1	0	8
P_2	1	4
P_3	2	9
P_4	3	5

- Preemptive* SJF Gantt Chart



- Average waiting time = $[(10-1)+(1-1)+(17-2)+5-3]/4 = 26/4 = 6.5$ msec



REFERENCES



TEXT BOOKS:

- T1 Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Ninth Edition, Wiley India Pvt Ltd, 2009.)
- T2. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education, 2010

REFERENCES:

- R1 Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004.
- R2 Harvey M. Deitel, “Operating Systems”, Third Edition, Pearson Education, 2004.
- R3 Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012.
- R4. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011