Operating Systems Tutorial

1. **Define** the term *Operating System* in your own words.
   - What are its two main roles?
2. Consider the following statement: > "The operating system is always the program running on the computer."
   - Do you agree? Why or why not?
3. What happens when you press the power button on your laptop?
   - Where is the bootstrap program stored?
4. Explain the difference between:
   - **Synchronous I/O** and **Asynchronous I/O**
   - Give one real-world example for each.
5. Why do we use **caching** in computer systems?
   - Give one example of cache you interact with daily (hardware or software).
6. **Dual-mode operation:**
   - What is the purpose of having *user mode* and *kernel mode*?
   - Give an example of an operation that requires kernel mode.
7. Fill in the blanks:
   - The OS uses a _____ to prevent a process from hogging the CPU.
   - A _____ occurs when the CPU is notified by a device that its task has finished.
8. In your own words, explain why **multiprogramming** improves CPU efficiency.
9. What is the difference between a **program** and a **process**?

- Use an everyday analogy (e.g., recipe vs cooking).

10. Process States:

    - Draw the **state diagram** of a process and label each state.

11. A system has 3 processes:

Process	Burst Time
P1	5 ms
P2	3 ms
P3	8 ms

- Compute the **average waiting time** using **FCFS scheduling** (assume processes arrive in order P1, P2, P3).
- Now compute again if the order is P2, P3, P1.

12. Consider the **Shortest Job First (SJF)** algorithm:

    - Why is it said to be "optimal"?
    - What practical difficulty do we face when trying to implement it?

13. Imagine you are designing the OS for a smartwatch.

    - List **two goals** of the OS for such a device.
    - Which components of the lecture (storage, interrupts, scheduling, etc.) are most critical in this case, and why?

14. Research question (not relavent for your exam):

    - Look up the terms **Linux kernel** and **Android OS**.
    - How are they related?