Exercise 1: Critical Path Analysis in Aircraft Maintenance Production Planning

Objective:
This exercise aims to demonstrate the application of Critical Path Analysis (CPA) in aviation maintenance activities. It will help participants understand how to efficiently plan and execute aircraft maintenance tasks by identifying the critical path and ensuring timely completion of key activities.

Scenario:

You are tasked with managing the maintenance of an Airbus A320 aircraft, which involves multiple activities that must be completed within a specific timeframe to return the aircraft to service. The following tasks are involved in this maintenance check:

1. **Task A:** Inspect engine components
   Duration: 3 hours
   Predecessor: None
2. **Task B:** Replace landing gear tires
   Duration: 4 hours
   Predecessor: None
3. **Task C:** Check avionics systems
   Duration: 2 hours
   Predecessor: Task A
4. **Task D:** Perform hydraulic system testing
   Duration: 5 hours
   Predecessor: Task A
5. **Task E:** Inspect fuel system
   Duration: 3 hours
   Predecessor: None
6. **Task F:** Lubricate control surfaces
   Duration: 2 hours
   Predecessor: Task E

7. **Task G:** Conduct post-maintenance testing and verification
   Duration: 2 hours
   Predecessor: Tasks C, D, F

Instructions:

1. **Step 1:**
   Create a diagram representing the tasks and their dependencies (use arrows to show which tasks depend on others). This will form the basis for your Critical Path Analysis.
2. **Step 2:**
   Calculate the **earliest start (ES)** and **earliest finish (EF)** times for each task, considering the task durations and dependencies.
3. **Step 3:**
   Calculate the **latest start (LS)** and **latest finish (LF)** times for each task, determining the maximum amount of time each task can be delayed without affecting the overall project timeline.
4. **Step 4:**
   Identify the **critical path** by determining which tasks, if delayed, would delay the entire project. These are the tasks with zero slack time.
5. **Step 5:**
   Use the critical path to determine the total duration of the maintenance check and identify any non-critical tasks that have some flexibility in their timing.

Discussion:

- How does Critical Path Analysis help in prioritizing tasks in aircraft maintenance?
- What are the potential risks if a critical path task is delayed?
- How can this method improve resource allocation and efficiency in the maintenance process?

Expected Outcome:

By the end of the exercise, participants should be able to:

- Construct a CPA diagram for the aircraft maintenance activities.
- Identify the critical path and its impact on the maintenance timeline.
- Make informed decisions on task prioritization and resource allocation to minimize downtime.