Exercise 2: Critical Path Analysis in Aircraft Maintenance Production Planning

Objective:
This exercise continues to demonstrate the application of Critical Path Analysis (CPA) in aviation maintenance production planning, using a different set of tasks and durations. It highlights the importance of identifying the critical path to streamline aircraft maintenance and avoid delays.

Scenario:

You are overseeing the **C-check** maintenance of a Boeing 737 aircraft. The C-check is a comprehensive inspection requiring detailed checks of various systems. The following tasks must be completed:

1. **Task A:** Cabin inspection and interior refurbishment
   Duration: 8 hours
   Predecessor: None
2. **Task B:** Check and service landing gear hydraulic systems
   Duration: 6 hours
   Predecessor: None
3. **Task C:** Perform deep engine inspection
   Duration: 12 hours
   Predecessor: Task B
4. **Task D:** Electrical systems check (including wiring and power distribution)
   Duration: 5 hours
   Predecessor: Task A
5. **Task E:** Inspect auxiliary power unit (APU)
   Duration: 4 hours
   Predecessor: None
6. **Task F:** Airframe structural integrity assessment
   Duration: 10 hours
   Predecessor: Task A

7. **Task G:** Functional testing and final verification of systems
   Duration: 3 hours
   Predecessor: Tasks C, D, F

Instructions:

1. **Step 1:**
   Construct a diagram showing the dependencies between the tasks. Ensure that the task dependencies and durations are clearly indicated.
2. **Step 2:**
   Calculate the **earliest start (ES)** and **earliest finish (EF)** times for each task, based on the task dependencies and durations.
3. **Step 3:**
   Calculate the **latest start (LS)** and **latest finish (LF)** times for each task, identifying how much flexibility (slack time) each task has.
4. **Step 4:**
   Identify the **critical path**—the sequence of tasks that cannot be delayed without impacting the overall maintenance schedule. Highlight tasks that have zero slack time.
5. **Step 5:**
   Determine the total time required to complete the C-check and analyze the tasks with potential delays that will not affect the overall project.

Task Details for Analysis:

- Task A (Cabin inspection) can start immediately and takes 8 hours.
- Task B (Hydraulic system check) can also start immediately and takes 6 hours.
- Task C (Engine inspection) depends on Task B and takes the longest—12 hours.
- Task D (Electrical systems check) depends on Task A, lasting 5 hours.
- Task E (APU inspection) is independent and takes 4 hours.

- Task F (Airframe assessment) depends on Task A and lasts 10 hours.
- Task G (Final testing and verification) depends on the completion of Tasks C, D, and F and takes 3 hours.

Discussion:

- How does Critical Path Analysis help in identifying bottlenecks in this maintenance scenario?
- What strategies could be employed to optimize resource allocation, particularly for tasks on the critical path?
- How can adjustments be made if unexpected issues arise during critical path activities, such as Task C (deep engine inspection)?

Expected Outcome:

Participants will:

- Understand the importance of critical path analysis in managing complex maintenance schedules.
- Construct a detailed CPA diagram, identifying the critical tasks.
- Determine the total project duration and understand where flexibility lies within the schedule.