

"Task Execution in Manufacturing Pipeline"

Simple Description

A manufacturing system includes multiple automated stages.

Some stages can only begin **after** others are finished. The goal is to determine a valid sequence of stage execution that satisfies all dependencies.

Problem Statement

Given the dependencies among production stages, determine a valid order in which all stages can be executed.

Input Format

- Dictionary where keys = stage names
- Values = list of prerequisite stages

Example Input

```
stages = { "Assembly": [], "QualityCheck": ["Assembly"], "Packaging": ["Assembly"],  
"Dispatch": ["QualityCheck", "Packaging"] }
```

Output

```
["Assembly", "QualityCheck", "Packaging", "Dispatch"]
```

Test Cases

1. `stages={"A":[], "B":["A"], "C":["B"]} → ["A","B","C"]`
2. `stages={"Cut":[], "Paint":["Cut"], "Polish":["Paint"], "Inspect":["Polish"]}`
3. `stages={"Mix":[], "Pour":["Mix"], "Set":["Mix"], "Finish":["Pour","Set"]}`
4. `stages={"Single":[]} → ["Single"]`

Complexity

- Time: $O(V + E)$
- Space: $O(V + E)$