

Scheduling and Digraphs

Lecture 33

Sections 8.1, 8.2

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- 1 Introduction
- 2 Definitions
- 3 Example
- 4 Digraphs
- 5 Project Digraphs
- 6 Priority Lists
- 7 Assignment

Outline

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Introduction

- To plan a meeting with several invited speakers involves a number of tasks:
 - (A) Locate appropriate speakers.
 - (B) Invite them to speak.
 - (C) Send out announcements of the meeting.
 - (D) Build a website to register attendees.
 - (E) Plan a banquet menu.
 - (F) Retain a caterer.
 - (G) Determine the registration fee.
 - (H) Reserve a room for the banquet.
 - (I) Update website with info.

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 - Plan a banquet menu.
- Some must be done in sequence.
 - Retain a caterer.
 - Plan a banquet menu.
 - Determine the registration fee.
 - Build a website to register attendees.
- If we know how long each task will take and if we know the “dependencies,” then we can figure out how long the entire project will take.

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Definitions

Definition (Task)

A **task** is a unit of work that cannot be broken down into smaller units.

Definition (Processor)

A **processor** is a person or a machine that carries out a task.

- Because a task cannot be broken down into parts, each task must be done by a single processor.

Definitions

Definition (Processing Times)

The **processing time** of a task is the time necessary to complete the task.

Definition (Precedence Relations)

Given two tasks, a **precedence relation** states that one of them must be *completed* before the other one can be *started*.

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Example

- Assume the following processor times.
 - (A) Locate appropriate speakers – 3 days.
 - (B) Invite them to speak (and get confirmation) – 4 days.
 - (C) Send out announcements of the meeting – 1 day.
 - (D) Build a website to register attendees – 3 days.
 - (E) Plan a banquet menu – 1 day.
 - (F) Retain a caterer – 2 days.
 - (G) Determine the registration fee – 1 day.
 - (H) Reserve a room for the banquet – 1 day.
 - (I) Update website with info – 1 day.

Example

- We have the following times and precedence relations.

	Task	Time	Precedent Tasks
(A)	Locate speakers	3	
(B)	Confirm speakers	4	A
(C)	Send announcements	1	B, D, E, G
(D)	Build website	3	
(E)	Plan menu	1	F
(F)	Retain caterer	2	
(G)	Registration fee	1	E
(H)	Banquet room	1	
(I)	Update website	1	B, D, E, G

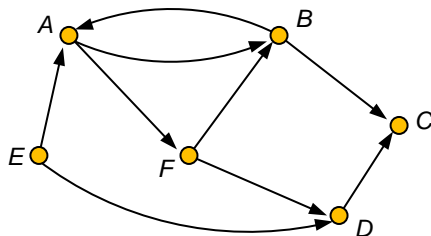
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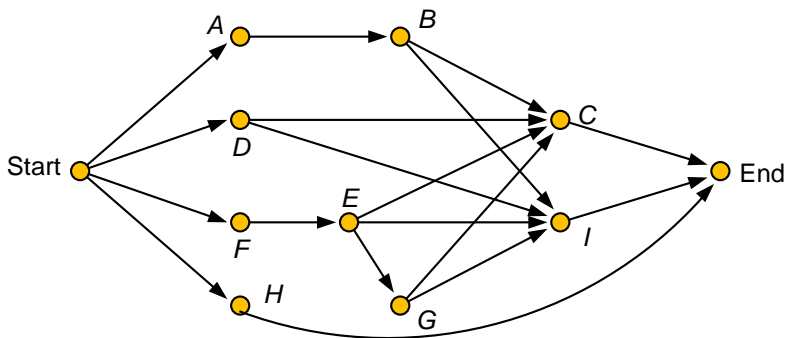
Definitions

Definition (Digraph)

A **digraph** is a “directed” graph. That is, each edge is given a direction, indicated by an arrowhead.

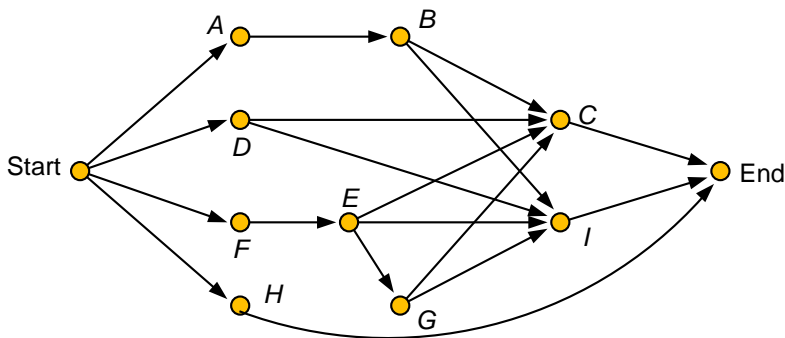


Example



- This digraph shows the precedence relations of our example.

Example



- This digraph shows the precedence relations of our example.
- Note the two additional vertices Start and End.

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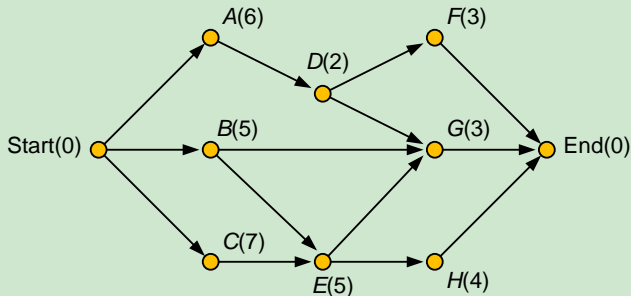
Project Digraphs

Definition (Project Digraph)

A **project digraph** is a digraph that displays the precedence relations among the tasks of a project as well as the process times for each task, and START and END vertices.

Example

Example (Project Digraph)



- The diagram shows the precedence relations.
- Some of the precedence relations are implied by the graph.

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Priority Lists

Definition (Priority List)

A **priority list** is a list of the tasks of a project, listed in the order in which we *prefer* to execute them.

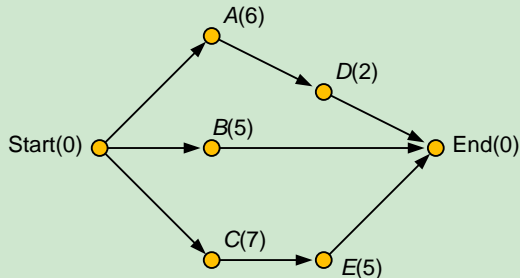
Definition (Priority List Model)

The **priority list model** uses a priority list to schedule the tasks. Whenever a processor is available, the model chooses the next task in the list that is ready to be processed. (To be ready, all precedent tasks must have been completed.)

- If there are M tasks, then there are $M!$ possible priority lists.
- It is not practical to try them all.

Example

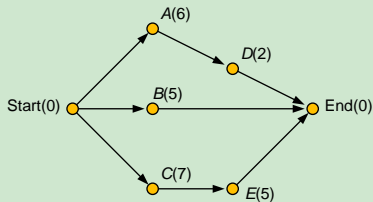
Example (Priority-List Scheduling)



- Suppose the priority list is A, B, C, D, E and that there are only 2 processors.
- What is the resulting schedule?

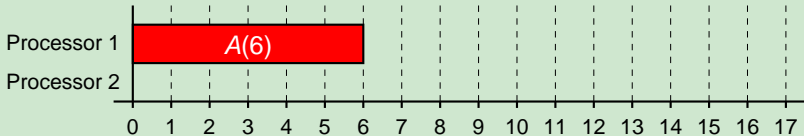
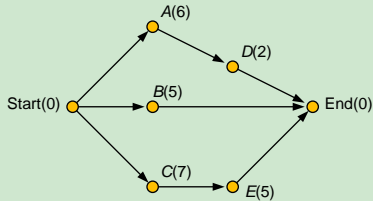
Example

Example (Priority-List Scheduling)



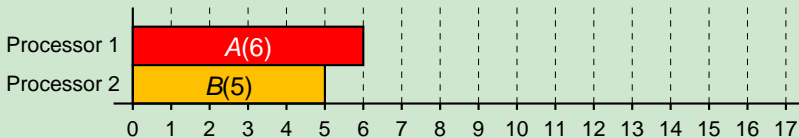
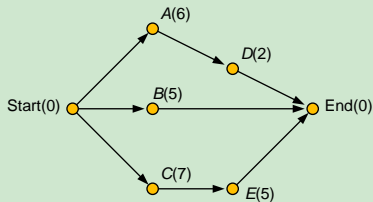
Example

Example (Priority-List Scheduling)



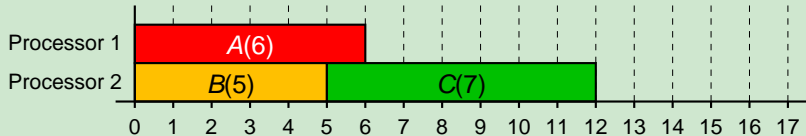
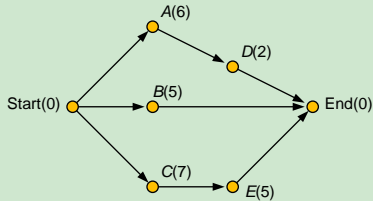
Example

Example (Priority-List Scheduling)



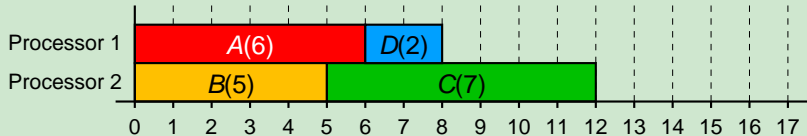
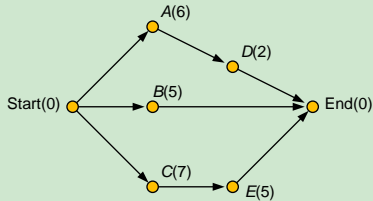
Example

Example (Priority-List Scheduling)



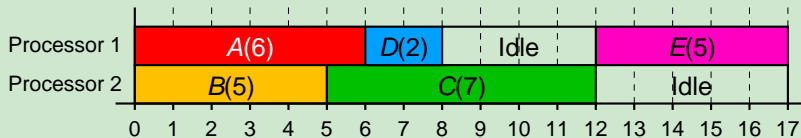
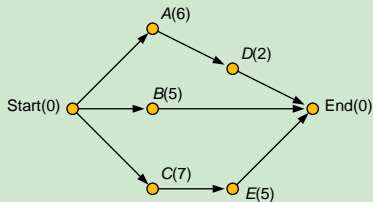
Example

Example (Priority-List Scheduling)



Example

Example (Priority-List Scheduling)



Example

Example (Priority-List Scheduling)

- What if there had been 3 processors?
- What if the priority list had been A, C, D, E, B ?
- What if the priority list had been E, D, C, B, A ?

Another Example

Example (Priority-List Scheduling)

	Task	Precedent Tasks	Time
(A)	Locate speakers		5
(B)	Confirm speakers	C, D	2
(C)	Send announcements		4
(D)	Build website		6
(E)	Plan menu	A, C, F	3
(F)	Retain caterer	A, B	1
(G)	Registration fee	F	4

- Schedule the tasks with priority list A, B, C, D, E, F, G with 2 processors.

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Assignment

Assignment

- Chapter 8 Exercises 4, 12, 13, 14, 16, 19, 20.