



COURSE

ENGI -8700
CIVIL
Design Project



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TOPIC

Lecture 3:
Design Project
Management

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<http://www.engr.mun.ca/~sbruneau/teaching/8700project>

Engi. 8700 Senior Civil Design Project

Lecture Series Summary

Purpose: To provide immediately practical guidance for the professional execution of the design project for 8700.

Method: One lecture per week with topics timed according to the approximate project phase. Total of 8 core lectures with 2 optional.

Topics:

1. Summary of the engineering design method, design steps 1 and 2, and record keeping - as required in 8700.
2. MS Project guidelines for use in 8700.
3. General project management . Teamwork, skills and tools.
4. Design steps 3 and 4 plus writing a project plan and project report .
5. Design steps 5 and 6 plus presenting and public speaking.
6. Life Cycle analysis and sustainability.
7. Probabilistic methods for cost estimating and load prediction.
8. Business, ethics, professional use of seal.



As seen from above . . .



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Engineering Project Management



Success

<http://www.youtube.com/user/tedtalksdirector?blend=1&ob=4#p/search/0/Y6bbMOXQ180>



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Project Management

A **project** is an interrelated set of activities with a definite starting and ending point, which results in a unique outcome for a specific allocation of resources.

The **three main goals of project** management are...

- Complete the project on time or earlier.
- Do not exceed the budget.
- Meet the specifications to the satisfaction of the customer.





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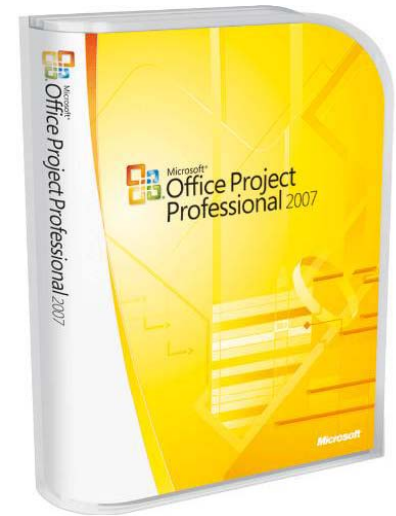
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Project Management

- **Project management** is a systemized, phased approach to defining, organizing, planning, monitoring, and controlling projects.
- A collection of projects is called a **program**, which is an interdependent set of projects with a common strategic purpose.
- **A cross-functional effort**: Even though a project may be under the overall purview of a single department, other departments likely should be involved.





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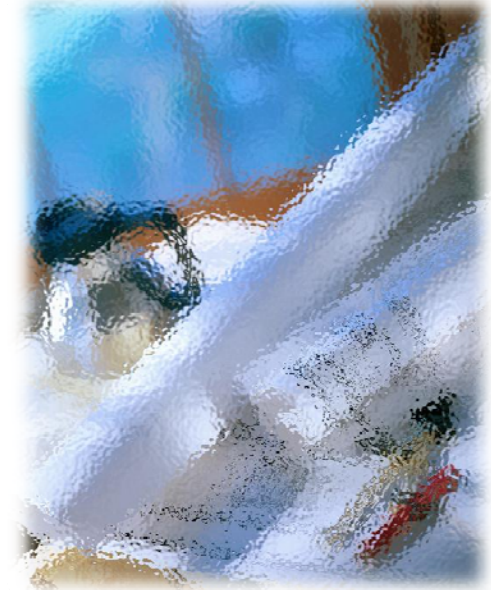
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Project Scope and Objectives

- Defining a project's scope, time frame, allocated resources and objective, is essential.
- A **Project Objective Statement** provides the objectives and essence of the project.
- Time frame should be specific for start and ending of the project.
- Necessary resources are also defined, either in dollar terms or in personnel allocation.





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Project Team



- Selecting the right **project manager** is critical and specific skills are needed.
 - **Facilitator**: Able to resolve conflicts, have leadership skills and a systems view.
 - **Communicator**: Ability to keep senior management informed, communicate progress, and work with team members.
 - **Decision Maker**: Able to organize members and make difficult decisions.
- **Team members** need to be technically competent, dedicated, and able to work well with other team members.



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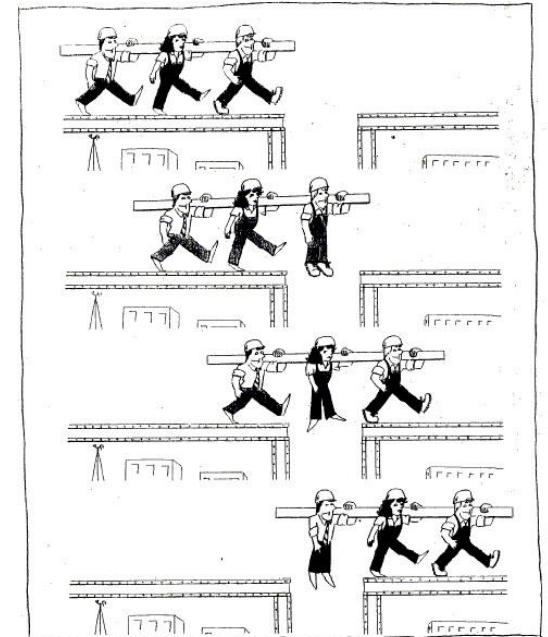
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Effective Team Building

Teamwork is an important skill that must be mastered if you are to be a good engineer. Working in a team requires that you speak clearly, write effectively and have the ability to assimilate another persons point of view. All members of a team must understand how their tasks relate to the responsibility of the team as a whole (read more from the text page 163 here).

The following set of guidelines illustrates one approach to building an effective design team:

- Agree upon Goals
- Define Clear Roles
- Define Procedures
- Develop good interpersonal relationships
- Define leadership roles





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Organizational Structure



- The relationship of a project manager to the team is determined by the firm's organizational structure.
 - **Functional Structure**: The team is housed in a specific functional area. Assistance from other areas must be negotiated.
 - **Pure Project**: Team members work exclusively for the project manager, which is best for large projects.
 - **Matrix Structure**: A compromise between the functional and project structures. Members remain in various functional areas and the project manager coordinates across functional areas. Dual authority can cause problems.



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Planning Projects

- Planning projects involves five steps:
 1. **Defining the work breakdown structure** -- a statement of all work that has to be completed.
 2. **Diagramming the network** -- a graphical network
 3. **Developing the schedule** -- specifying start times for each activity
 4. **Analyzing cost-time trade-offs**
 5. **Assessing risks**





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Defining the Work Breakdown Structure

- A **Work Breakdown Structure** is simply a statement of all work that has to be completed.
- Major work components are identified and then broken down into smaller tasks by the project team.
 - This process may involve a hierarchy of work levels.
- An **Activity** is the smallest unit of work effort consuming both the time and resources that the project manager can schedule and control.
- **Task Ownership**: Each activity must have an owner who is responsible for doing the work.





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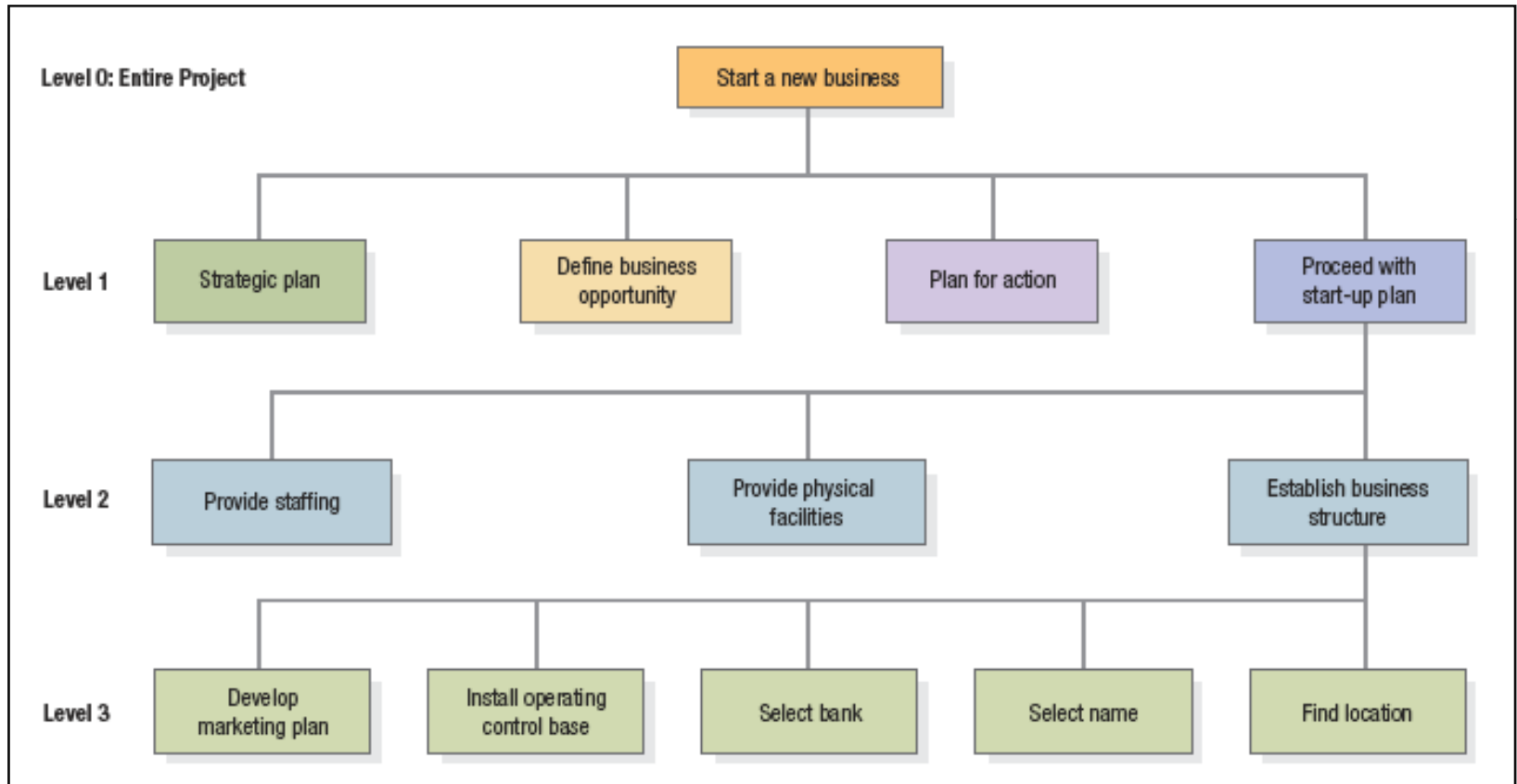
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A Work Breakdown Structure for a new business



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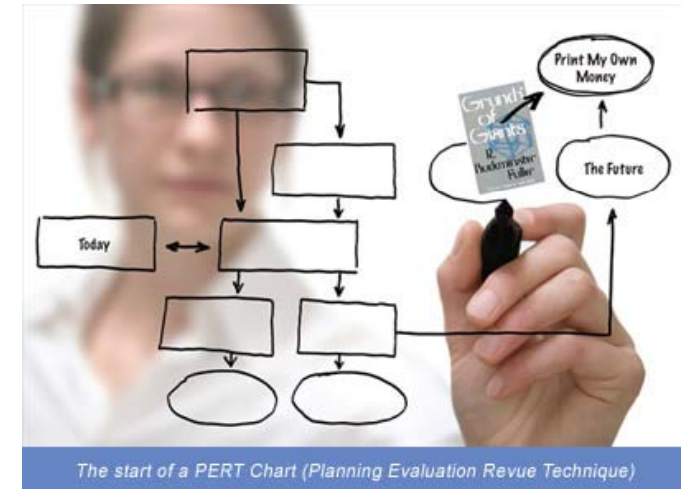
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Diagramming the Network



- A **Network Diagram** visually displays the interrelated activities using nodes (circles) and arcs (arrows) that depict the relationships between activities.
- Two network planning methods (PERT & CPM) were originally distinctive, but today the differences are minor and will be jointly referred to as **PERT/CPM**.
 - **PERT** (Program Evaluation and Review Technique) was utilized when activity times involved risk.
 - **CPM** (Critical Path Method) was used when activity times were certain.

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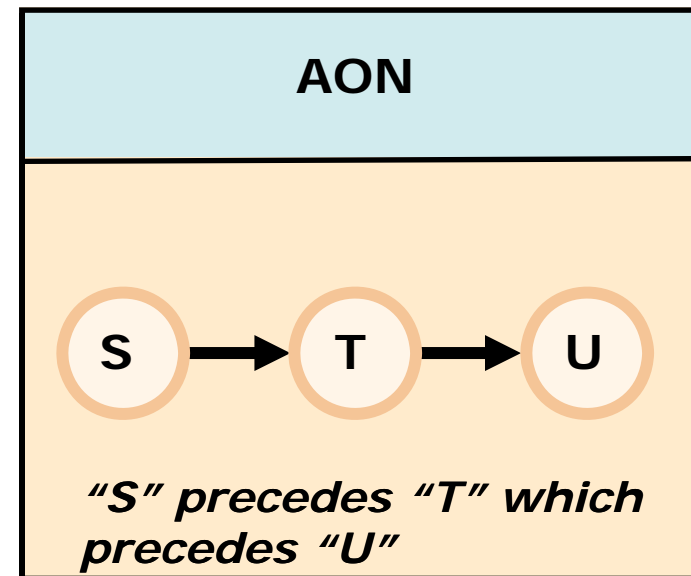
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Precedence Relationships

- **Precedence relationships** determine a sequence for undertaking activities, and specify that any given activity cannot start until a preceding activity has been completed.

In the **AON approach**, the nodes (circles) represent activities, and the arcs represent the precedence relationships between them.

Activity On Node approach





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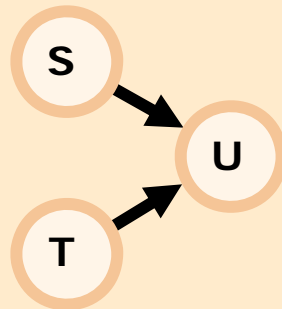
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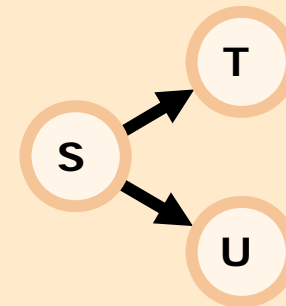
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Activity Relationships

S & T must be completed before U can be started.



T & U cannot begin until S has been completed.





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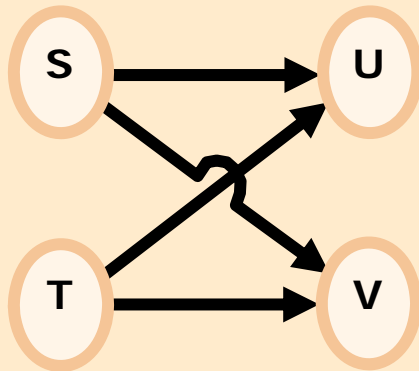
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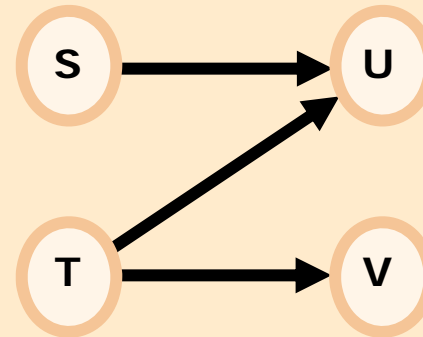
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Activity Relationships

U & V can't begin until S & T have been completed.



U cannot begin until S & T have been completed. V cannot begin until T has been completed.





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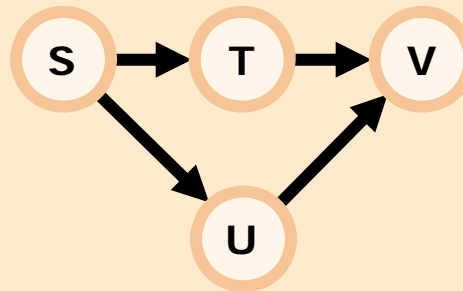
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Activity Relationships

T & U cannot begin until S has been completed; V cannot begin until both T & U have been completed.





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Hospital Example



<u>Activity</u>	<u>Description</u>
-----------------	--------------------

- | | |
|----------|--|
| A | Select administrative and medical staff. |
| B | Select site and do site survey. |
| C | Select equipment. |
| D | Prepare final construction plans and layout. |
| E | Bring utilities to the site. |
| F | Interview applicants and fill positions in nursing, support staff, maintenance, and security. |
| G | Purchase and take delivery of equipment. |
| H | Construct the hospital. |
| I | Develop an information system. |
| J | Install the equipment. |
| K | Train nurses and support staff. |



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Hospital Example

Activity	Description	Predecessor(s)	Immediate Responsibility
A	Select administrative and medical staff.	—	Johnson
B	Select site and do site survey.	—	Taylor
C	Select equipment.	A	Adams
D	Prepare final construction plans and layout.	B	Taylor
E	Bring utilities to the site.	B	Burton
F	Interview applicants and fill positions in nursing, support staff, maintenance, and security.	A	Johnson
G	Purchase and take delivery of equipment.	C	Adams
H	Construct the hospital.	D	Taylor
I	Develop an information system.	A	Simmons
J	Install the equipment.	E,G,H	Adams
K	Train nurses and support staff.	F,I,J	Johnson



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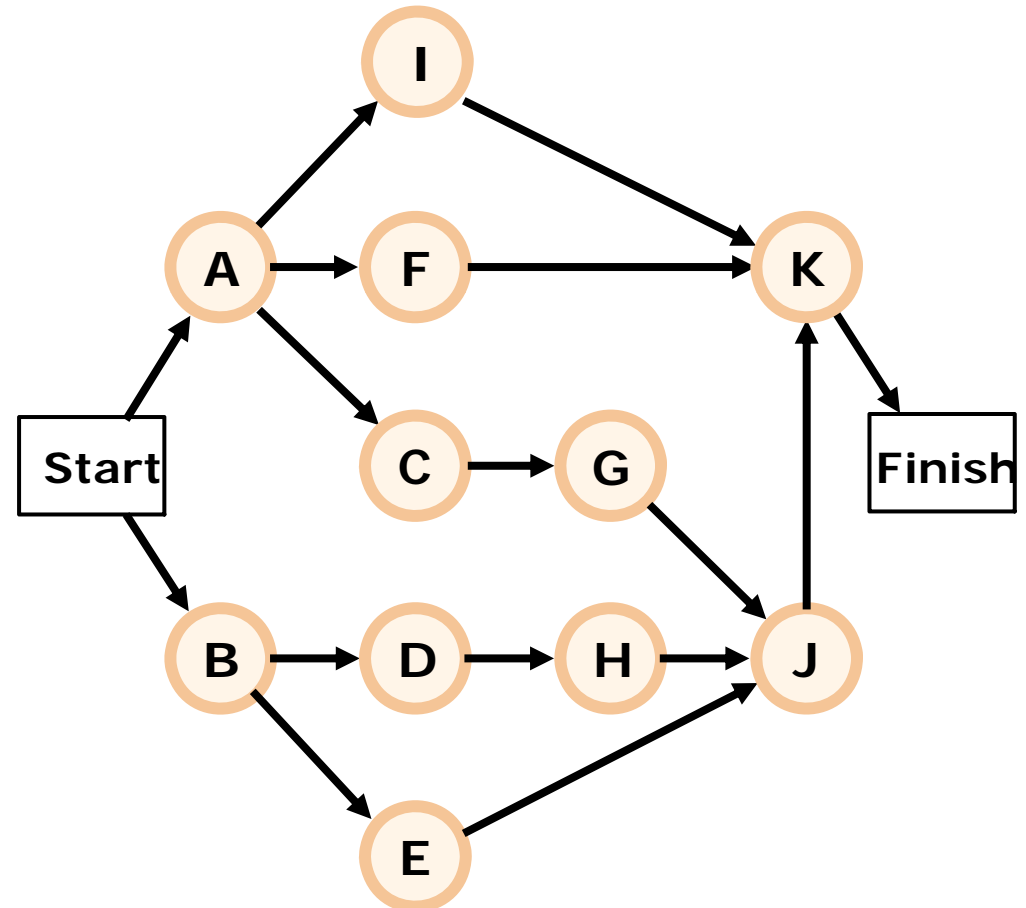
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Hospital Example

Diagramming the Network

*Immediate
Predecessor*

A	—
B	—
C	A
D	B
E	B
F	A
G	C
H	D
I	A
J	E, G, H
K	F, I, J





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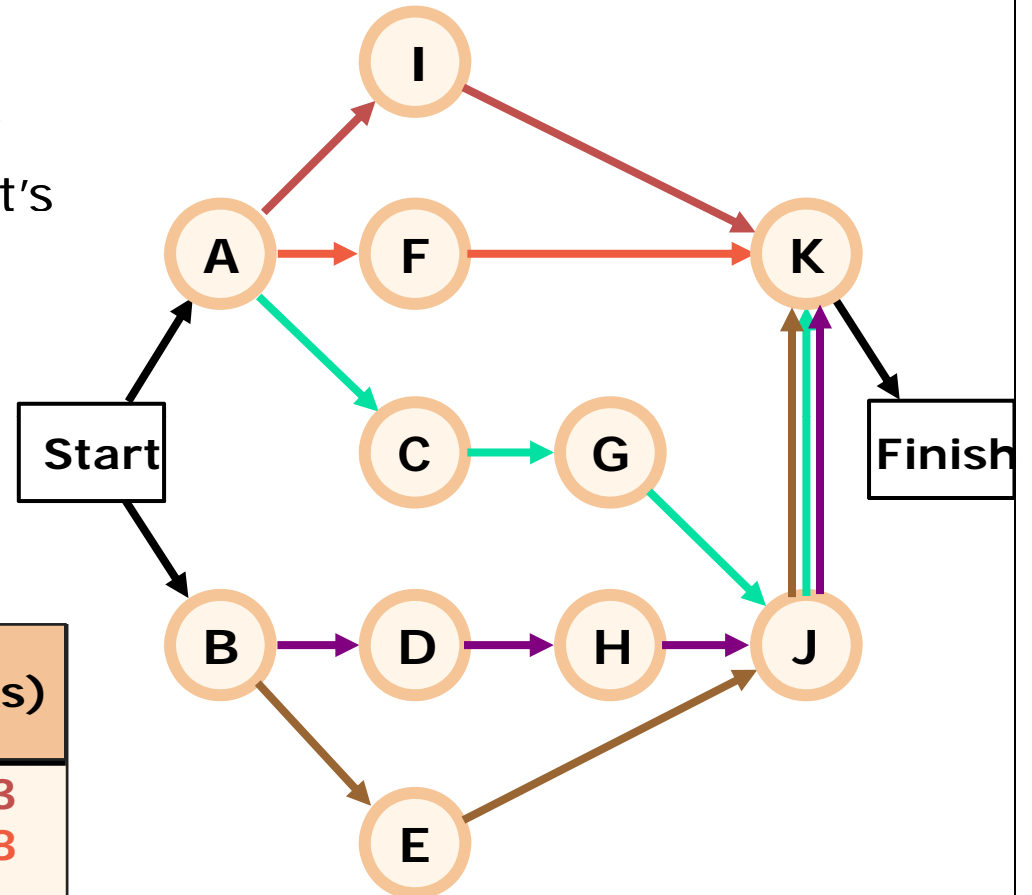
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Hospital Example

Paths are the sequence of activities between a project's start and finish.



Path	Time (wks)
A-I-K	33
A-F-K	28
A-C-G-J-K	67
B-D-H-J-K	69
B-E-J-K	43



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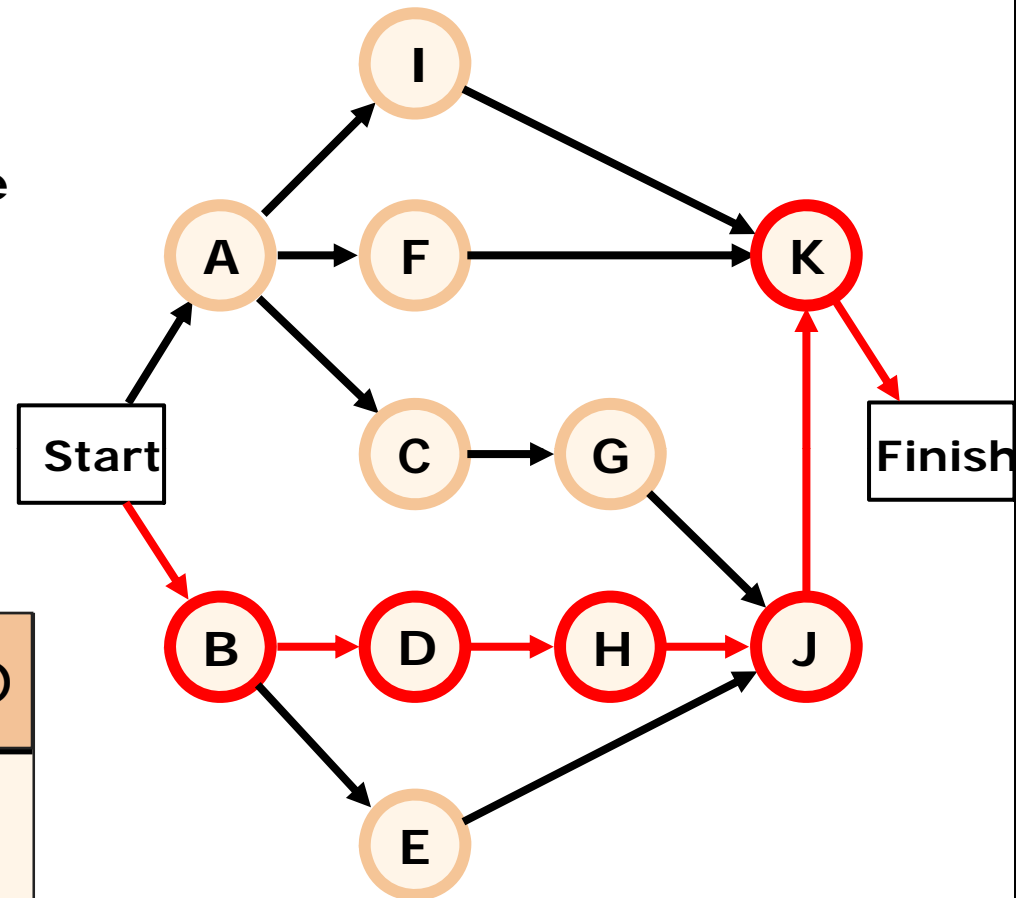
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Hospital Example

The critical path is the longest path!



Project Expected
Time is 69 wks.

Path	Time (wks)
A-I-K	33
A-F-K	28
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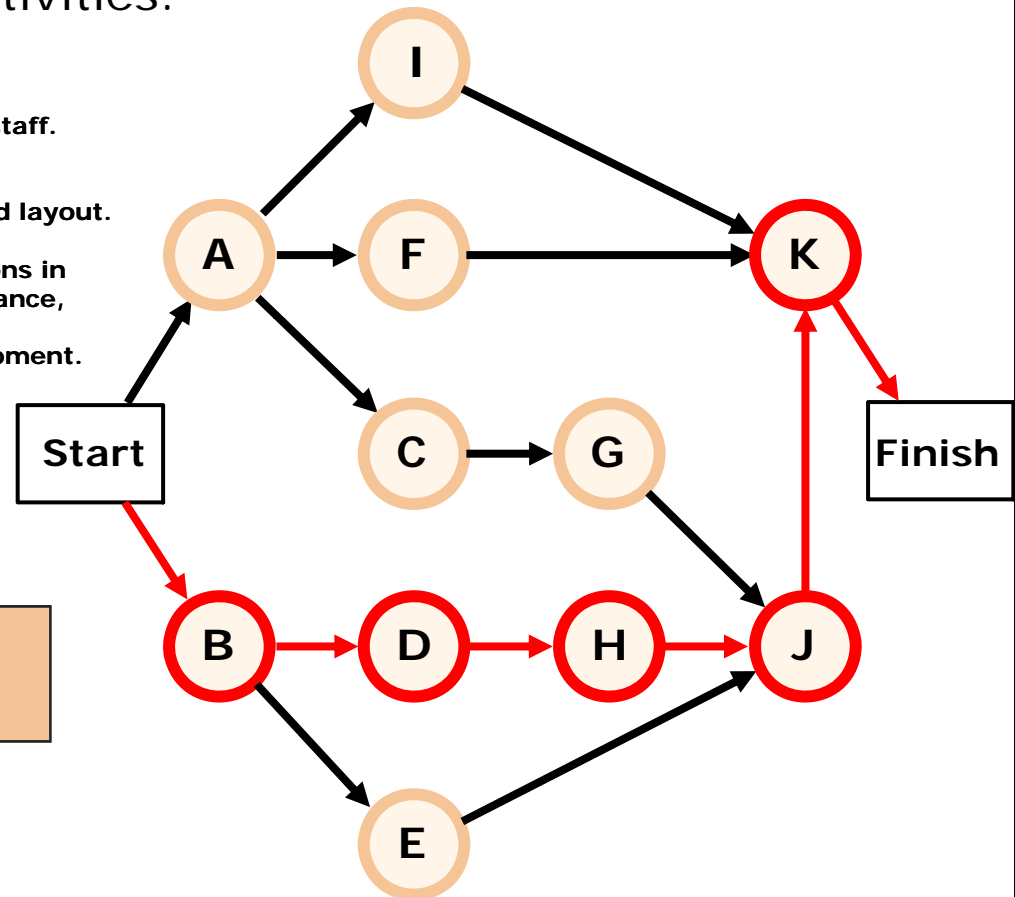
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EXAMPLE Summary

A **Network Diagram** visually displays the interrelated activities using nodes (circles) and arcs (arrows) that depict the relationships between activities.

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- B Select site and do site survey.
- C Select equipment.
- D Prepare final construction plans and layout.
- E Bring utilities to the site.
- F Interview applicants and fill positions in nursing, support staff, maintenance, and security.
- G Purchase and take delivery of equipment.
- H Construct the hospital.
- I Develop an information system.
- J Install the equipment.
- K Train nurses and support staff.



Path	Time (wks)
A-I-K	33
A-F-K	28
A-C-G-J-K	67
B-D-H-J-K	69
B-E-J-K	43

The **critical path** is the longest path!

Project Expected Time is 69 wks.



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Project Schedule

- A **Gantt Chart** is a project schedule, usually created by the project manager using computer software, that superimposes project activities, with their precedence relationships and estimated duration times, on a time line.
 - Activity slack is useful because it highlights activities that need close attention.
- **Free slack** is the amount of time an activity's earliest finish time can be delayed without delaying the earliest start time of any activity that immediately follows.
 - Activities on the critical path have zero slack and cannot be delayed without delaying the project completion.



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Hospital Example

Developing the Schedule

- The project team must make time estimates for each activity.
- Activity times may be risky, in which case a probability distribution can be used (CPM).
- For this project the times will be certain.
- **Activity slack** is the maximum length of time that an activity can be delayed without delaying the entire project.
 - For this example we can't go beyond 69 weeks.



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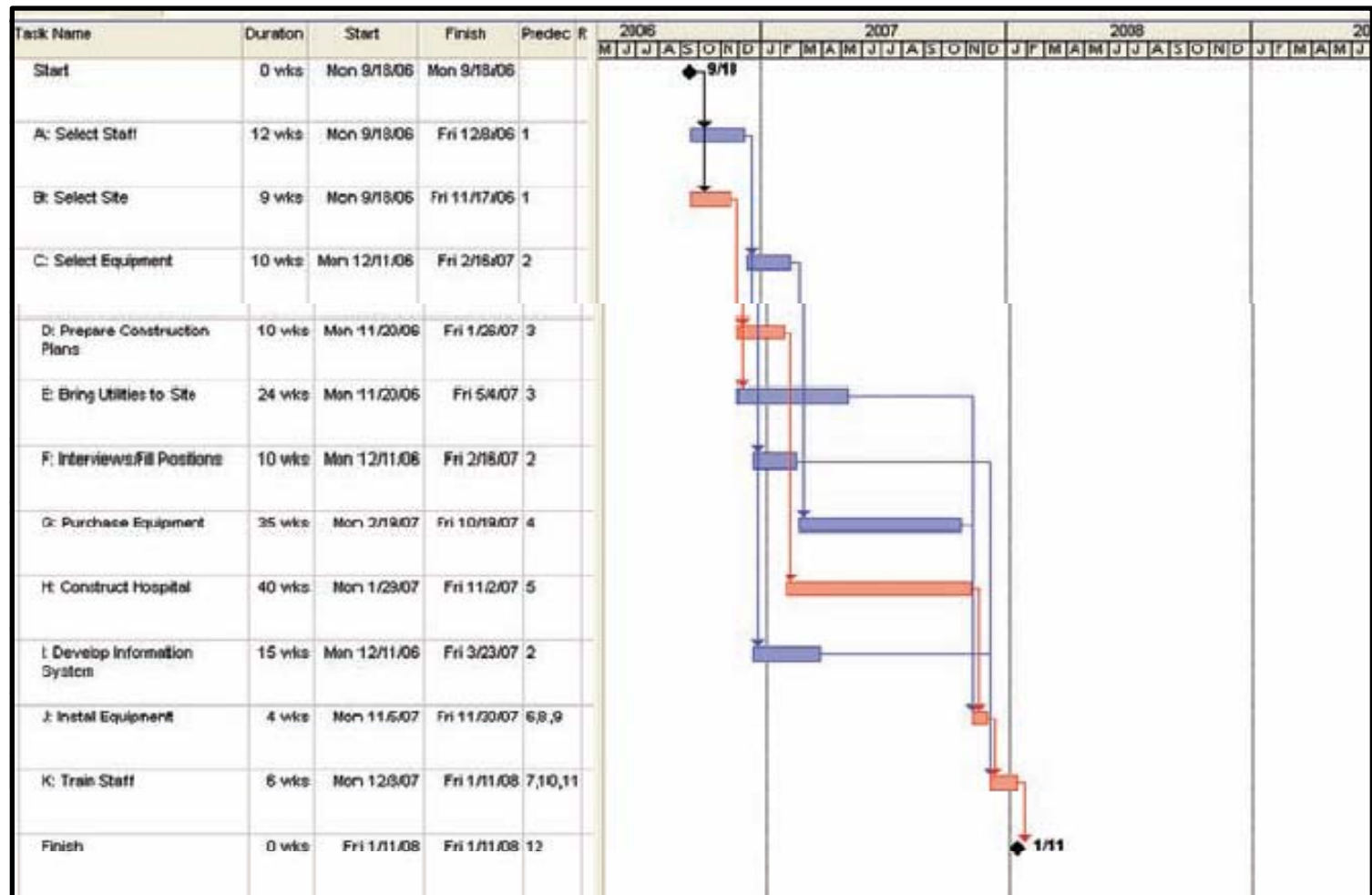
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Hospital Example Gantt Chart





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Analyzing Cost-Time Trade-Offs

- There are always cost-time trade-offs in project management.
 - You can complete a project early by hiring more workers or running extra shifts.
 - There are often penalties if projects extend beyond some specific date, and a bonus may be provided for early completion.
- **Crashing** a project means expediting some activities to reduce overall project completion time and total project costs.



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Project Costs

- The **total project costs** are the sum of direct costs, indirect costs, and penalty costs.
- **Direct costs** include labor, materials, and any other costs directly related to project activities.
- **Indirect costs** include administration, depreciation, financial, and other variable overhead costs that can be avoided by reducing total project time.
 - The shorter the duration of the project, the lower the indirect costs will be.



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Assessing Risks

- **Risk** is a measure of the probability and consequence of not reaching a defined project goal.
- A major responsibility of the project manager at the start of a project is to develop a risk-management plan.
- A **Risk-Management Plan** identifies the key risks to a project's success and prescribes ways to circumvent them.



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Categories of Project Risk

- **Strategic Fit:** Projects should have a purpose that supports the strategic goals of the firm.
- **Service/Product Attributes:** If the project involves new service or product, several risks can arise.
 - **Market risk** comes from competitors.
 - **Technological risk** can arise from advances made once the project has started, rendering obsolete the technology chosen for service or product.
 - **Legal risk** from liability suits or other legal action.
- **Project Team Capability:** Involves risks from the project team itself such as poor selections and inexperience.
- **Operations Risk:** Information accuracy, communications, and project timing.



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Resource-Related Problems

- **Excessive Activity Duration Estimates:** Many time estimates come with a built-in cushion that management may not realize.
- **Latest Date Mentality:** The tendency for employees to procrastinate until the last moment before starting.
- **Failure to Deliver Early,** even if the work is completed before the latest finish date.



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Resource-Related Problems



- **Path Mergers** occur when two or more activity paths combine at a particular node. Both paths must be completed up to this point, which will eliminate any built-up slack.
- **Multitasking** is the performance of multiple project activities at the same time. Work on some activities is delayed for other work.
- **Loss of Focus** by a manager can happen if the critical path changes frequently.



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Lecture 3:
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Management

REFERENCES.

FILES

WEB

<http://www.engr.mun.ca/~sbruneau/teaching/8700project>

Project Management

Remember the importance of the planning exercise itself. It has been argued that the project plan rapidly becomes worthless if not up dated but that the planning exercise is always invaluable.



The end