CSCI 1106
Lecture 12
Project Management

Announcements

• Today’s Topics
  – Motivation
  – What’s to manage
  – Scheduling tasks
  – Gantt charts
  – Managing risk
How well did You Manage your Time?

• The first module is nearly up!
• Did you have enough time?
• Were you able to get everything done?
• Did you make effective use of your time?

The Problem

• A project consists of many parts
  – Tasks
  – Goals and milestones
  – Dependencies
  – Resources
  – Risks
• To complete a project
  – Finish all tasks on time
  – Accomplish all goals
  – Satisfy all dependencies
  – Use only the allocated resources
  – Adapt to things going wrong
Example: Thanksgiving Dinner for 8

• Tasks
  – Prepare meal
  – Clean house
  – Set the table

• Dependencies
  – Set table after house is clean
  – Roast turkey after stuffing is made
  – Make gravy after turkey is done

• Risks?

• Goals
  – Prepare meal by 7pm
  – Clean house by 2pm
  – Set table by 6pm

• Resources
  – One cook
  – One helper
  – One turkey
  – One oven and stove
  – $200 dollars for supplies
  – 8 place settings

• Time: 8am to 7pm

Things to Consider

• Tasks take a set amount of time
• Some task must precede other tasks
• Resources are limited
• Things go wrong
Example: Robotics Project

- **Tasks**
  - Create three programs
  - Write one report
  - Participate in Olympics
- **Dependencies**
  - Programs must be finished before Olympics
  - Report must be completed after Olympics
- **Risks?**

- **Goals**
  - Finish programs by Oct 18
  - Finish report by Oct 22
  - Finish Olympics by Oct 18/19
- **Resources**
  - One Tribot
  - One computer
  - Three to four people
- **Time**
  - Five 2-hour lab periods
  - 21 evenings and nights

The Goal of Project Management

- Identify and schedule tasks
- Allocate resources
- Anticipate and manage risks

- Complete a project on time and on budget

- Why is this lecture so late in the term?
Tasks

• A task
  – Takes a minimum amount of time to complete
  – Requires specific resources
  – Requires certain other tasks to be completed first
  – Must be completed before other tasks can begin
  – May take longer than expected due to unanticipated events
• For each task we need to identify
  – What the task is
  – What resources it requires
  – What tasks does it depend on
  – How much time the task will take

Identifying Tasks

• How do we identify all the tasks?
• Idea: Work backwards (reverse engineering)
  – Start with the end goal
  – Ask what task(s) are needed to achieve the goal
  – Ask what resources are needed for the tasks
  – For each task break it down into subtasks and repeat
• Does this sound familiar?
Identifying Tasks

Example: Thanksgiving Dinner
Scheduling Tasks

• Problem:
  – There are many tasks
  – There are many resources
  – Each task may have multiple dependencies

• Need to
  – Organize all of them in one place
  – Sort dependencies
  – Check for resource contention

• Idea: Use a Gantt chart
Gantt Chart Rules

- Time is represented horizontally (left to right)
- Resources are denoted vertically
- A task requires both time and resources
  - Represented by one or more rectangles
- If two tasks require the same resource, they cannot overlap
- If task A depends on task B, task A must follow task B
- The minimum amount of time needed to fit in all the tasks is the minimum amount needed for the project

Example: Turkey Dinner

<table>
<thead>
<tr>
<th></th>
<th>Hour 1</th>
<th>Hour 2</th>
<th>Hour 3</th>
<th>Hour 4</th>
<th>Hour 5</th>
<th>Hour 6</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oven</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pan</td>
<td></td>
<td>Stuffing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burner 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Burner 2</td>
<td></td>
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</tr>
<tr>
<td>Burner 3</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Burner 4</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sink</td>
<td>Wash Turkey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining Room</td>
<td>Clean</td>
<td></td>
<td>Set Table</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What resources are missing here?
Purpose of Gantt Chart

- Represent all tasks
- Represent resource use
- Represent dependencies
- Represent time of tasks

Question: How do we know where to place what on the chart?

Three Main Issues

- Dependency chains
- Resource contention
- Risk management
Dependency Chains

- Task A depends on B depends on C depends on D ...
- Time of longest chain is the minimum time of the project
- Place longest chain first
- Then the next longest ...

Resource Contention

- Tasks cannot use a resource at the same time
- A bottleneck occurs when many tasks need the same resource
- Stagger tasks to avoid resource contention
- Add more resources to reduce contention
Risk Management

• Things will take longer than you think!
  – What happens to our schedule if the stuffing is burnt?
• How do we accommodate this fact of life?
• Solutions:
  – Schedule tasks as early as possible to provide time to deal with unforeseen events
  – Schedule extra time for each task
    • 10% to 15% extra time per task is not uncommon

Expectation

Try applying these techniques in the next module