

Timmy Li

MSDS460

Assignment 2

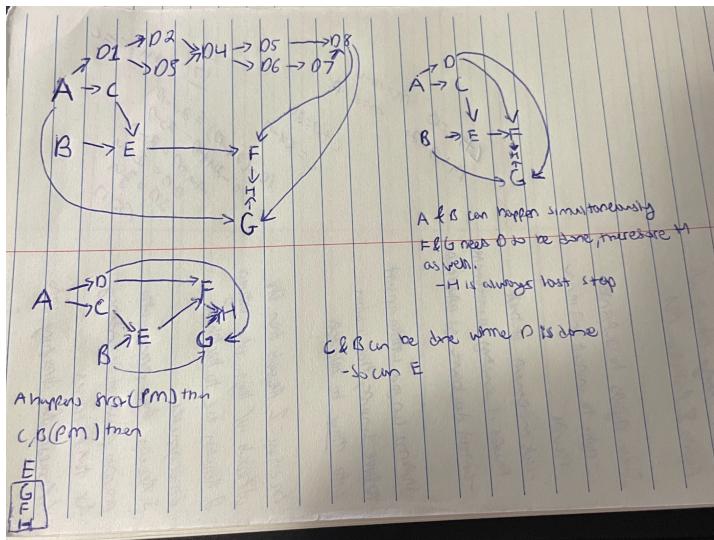
Part 1: Problem setup

There are quite a few tasks that need to be done for this project. There's also a couple things to note about the way this project can be looked at. For the purposes of this project, all of the hourly rates for members of the team are the same, at sixty dollars an hour. Differences in pay will be determined by how much each member works. Our team consists of a project manager, front end developer, backend developer, data scientist, and data engineer. The roles of project manager and data scientist will be filled by me. The frontend developer, backend developer, and data engineer will need to be found. Tasks include, Describe product (PM), Develop marketing strategy (PM), Design brochure (PM or FD), Develop product prototype which has the following subtasks: Requirements analysis (PM), Software design(BD and FD), System design(BD and DE), Coding(FD and BD), Write documentation(PM and Devs), Unit testing (FD and BD), System testing (DE and BD), Package deliverables (PM) and then Survey potential market (PM), Develop pricing plan (PM), Develop implementation plan (PM), Write client proposal (PM). The team member described next to the task is who would be most suited for each task. The frontend developer, backend developer, and data engineer will mostly be working for the developing product prototype task.

The following is the task excel with all the hours for each case.

taskID	task	predecessorTaskIDs	bestCaseHours	expectedHours	worstCaseHours	projectManager(me)	frontendDeveloper	backendDeveloper	dataScientist(me)	dataEngineer
A	Describe product (PM)		8	16	24					
B	Develop marketing strategy (PM)		16	24	32					
C	Design brochure (PM or FD)	A	16	24	32					
D	Develop product prototype		272	432	544					
D1	Requirements analysis (PM)	A	24	32	48					
D2	Software design(BD and FD)	D1	40	56	80					
D3	System design(BD and DE)	D1	40	80	160					
D4	Coding(FD and BD)	D2, D3	80	120	160					
D5	Write documentation(PM and Devs)	D4	16	24	32					
D6	Unit testing (FD and BD)	D4	24	40	48					
D7	System testing (DE and BD)	D6	32	56	64					
D8	Package deliverables (PM)	D5, D7	16	24	32					
E	Survey potential market (PM)	B, C	24	40	48					
F	Develop pricing plan (PM)	D8, E	16	24	32					
G	Develop implementation plan (PM)	A, D8	24	40	48					
H	Write client proposal (PM)	F, G	16	24	32					
			392	624	872					

Below are the directed graphs, they're all the same just slightly different looks



Part 2: Model specification.

For the purposes of the assignment, all of the hourly rates for each member are the same. This means we are looking for the minimum total time. Also as noted in the assignment instructions we are assuming that there are no resource constraints. Meaning there are no constraints on who can work on what task or limits on hours working in a day. In real life there are constraints such as those. We're going to be disregarding those things but we still have preceding tasks that we need to be careful of.

Some of the rules that we need to follow. Task A comes before task D and C. Task B could technically be done at the same time as A. Task E needs B and C done first. Task F needs E and D done before. Task G Needs D and B to be completed. Task H needs to be done after F and G are completed. There are subsets within task D that have precedences as well. Task D2 and D3 need to be done after D1. D4 needs D2 and D3 to be done. D5 and D6 need D4 done. D7 needs D6 to be done. D8 needs D5 and D7 to be done.

The objective function would look something like this which is based on the best case hours.

Minimize Time =

$$\max\{tA+8, tB+16, tC+16, tD1+24, tD2+40, tD3+40, tD4+80, tD5+16, tD6+24, tD7+32,$$

tD8+16,E+24,F+16,G+24,tH+16}

Part 4: Solution.

Best case solution was 240 hours, expected case solution was 392 hours, worst case solution was 568 hours.

Critical Paths for each scenario

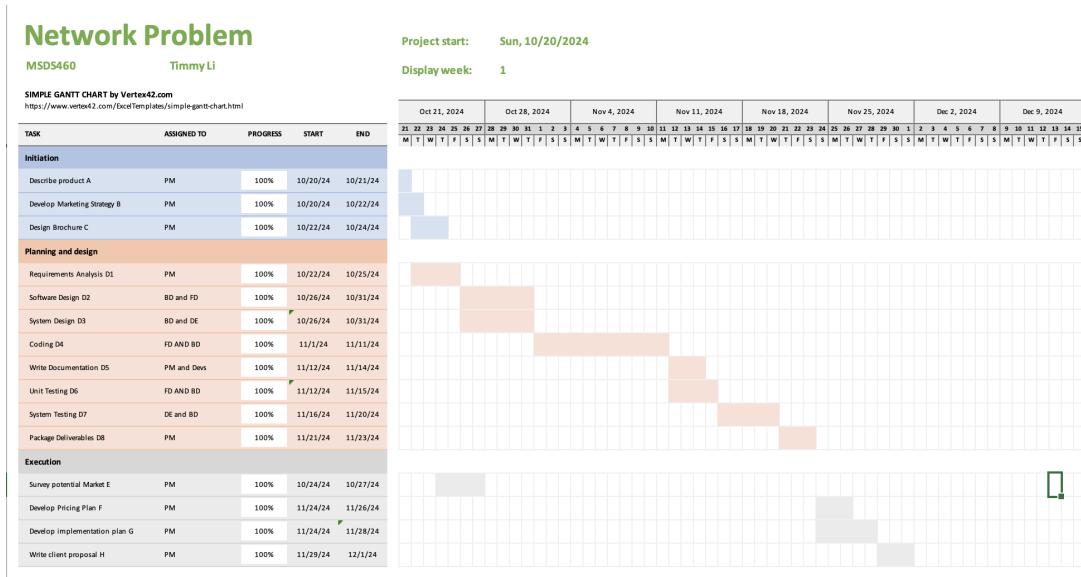
Best: A to D1 to D2 or D3 to D4 to D6 to D7 to D8 to G to H

Expected: A to D1 to D3 to D4 to D6 to D7 to D8 to G to H

Worst: A to D1 to D3 to D4 to D6 to D7 to D8 to G to H

Expected and worst critical paths are the same. For the best hours scenario, there was no difference between D2 and D3.

Best Case



Expected Case

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SIMPLE GANTT CHART by Vertex42.com
<https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html>

TASK	ASSIGNED TO	PROGRESS	START	END	
Initiation					
Describe product A	PM	100%	10/20/24	10/22/24	
Develop Marketing Strategy B	PM	100%	10/20/24	10/23/24	
Design Brochure C	PM	100%	10/23/24	10/26/24	
Planning and design					
Requirements Analysis D1	PM	100%	10/23/24	10/27/24	
Software Design D2	BD and FD	100%	10/28/24	11/4/24	
System Design D3	BD and DE	100%	10/28/24	11/7/24	
Coding D4	FD AND BD	100%	11/8/24	11/23/24	
Write Documentation D5	PM and Devs	100%	11/24/24	11/27/24	
Unit Testing D6	FD AND BD	100%	11/24/24	11/29/24	
System Testing D7	DE and BD	100%	11/30/24	12/7/24	
Package Deliverables D8	PM	100%	12/8/24	12/11/24	
Execution					
Survey potential Market E	PM	100%	10/26/24	10/31/24	
Develop Pricing Plan F	PM	100%	12/12/24	12/15/24	
Develop implementation plan G	PM	100%	12/12/24	12/17/24	
Write client proposal H	PM	100%	12/18/24	12/21/24	

Worst Case

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TASK	ASSIGNED TO	PROGRESS	START	END	
Initiation					
Describe product A	PM	100%	10/20/24	10/23/24	
Develop Marketing Strategy B	PM	100%	10/20/24	10/24/24	
Design Brochure C	PM	100%	10/24/24	10/28/24	
Planning and design					
Requirements Analysis D1	PM	100%	10/24/24	10/30/24	
Software Design D2	BD and FD	100%	10/31/24	11/10/24	
System Design D3	BD and DE	100%	10/31/24	11/20/24	
Coding D4	FD AND BD	100%	11/21/24	12/11/24	
Write Documentation D5	PM and Devs	100%	12/12/24	12/16/24	
Unit Testing D6	FD AND BD	100%	12/12/24	12/18/24	
System Testing D7	DE and BD	100%	12/19/24	12/27/24	
Package Deliverables D8	PM	100%	12/28/24	1/1/25	
Execution					
Survey potential Market E	PM	100%	10/28/24	11/3/24	
Develop Pricing Plan F	PM	100%	1/2/25	1/6/25	
Develop implementation plan G	PM	100%	1/2/25	1/8/25	
Write client proposal H	PM	100%	1/9/25	1/13/25	

Part 5: Overview.

The goal of this project is to create a recommendation system for restaurants in Marlborough, Massachusetts, using Yelp reviews for the data. The frontend will be built using Alpine.js and Tailwind, a GraphQL API, and a Go web and database server on the backend.

Python will be used for recommender system analytics on the backend, with persistent storage provided by PostgreSQL. Data storage will use PostgreSQL. The entire system will be hosted on AWS.

Based on the hourly rates for everyone being sixty dollars an hour, the expected number of hours being 624 the amount for labor would cost \$37,440. This would just be for the hours spent on the tasks themselves. There are other costs associated with starting a project which probably round up the total costs for the project to be about \$40,000. This is based on the expected hours, in a best case scenario the total hours would be 392 hours which would have labor costs at \$23,520. Let's say we added a few more workers, one more of each of the roles so that the number of actual hours could be halved. If we used the expected solution of 392 hours, and say that working hours are 8 hours a day, it would take about 50 days. Using the expected case solution of 392 hours required for the project, the number of hours this would take would be 196 which is about 25 days.