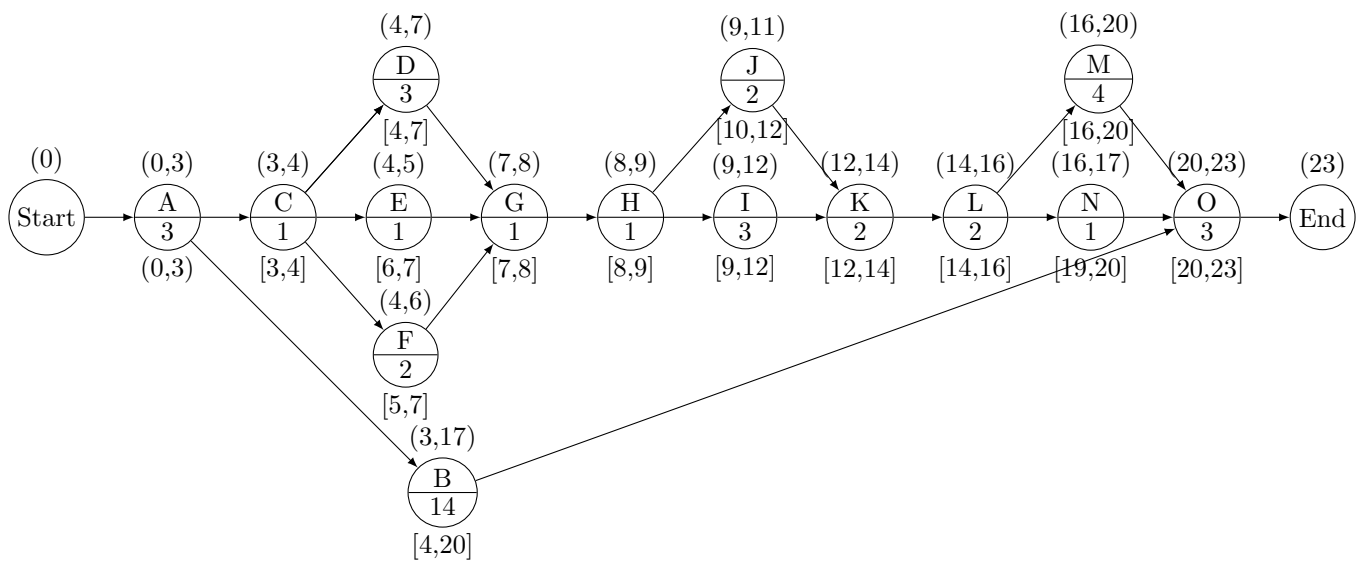# Homework II

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EE 382C Program Management

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Problem 9.14

Critical path: A-C-D-G-H-I-K-L-M-O
Duration: 23 days
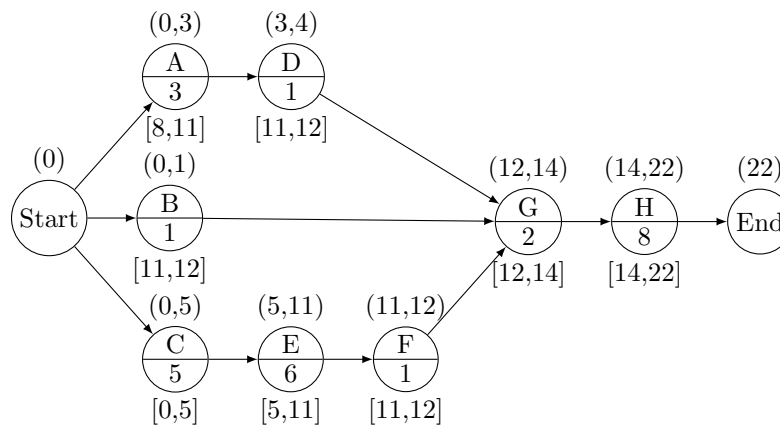
Problem 9.15

Table 1: Slacks for Buying Tom Cruise a Boat

Activity	Total Slack Eq LS - ES	Total Slack	Free Slack Eq $\text{Min}\{ES_{\text{Suc}}\}$ - EF	Total Slack
A*		0		0
B	20-17=	3	20-17=	3
C*		0		0
D*		0		0
E	7-5=	2	7-5=	2
F	7-6=	1	7-6=	1
G*		0		0
H*		0		0
I*		0		0
J	12-11=	1	12-11=	1
K*		0		0
L*		0		0
M*		0		0
N	20-17=	3	20-17=	3
O*		0		0

* = On the Critical Path

Problem 9.19

(a)

(b)

Table 2: Slacks for Buying Tom Cruise a Boat

Activity	Total Slack Eq LS - ES	Total Slack	Free Slack Eq $\text{Min}\{ES_{Suc}\}$ - EF	Total Slack
A	8-0=	8	3-3=	0
B	11-0=	11	12-1=	11
C*		0		0
D	11-3=	8	12-4=	8
E*		0		0
F*		0		0
G*		0		0
H*		0		0

* = On the Critical Path

The total slack means that the activity may be delayed from the early start by that amount of time without affecting the total project duration; the free slack is the amount of time the activity may be delayed without delaying any other activity in the project.

For this project, investigating the demand can be delayed for 8 weeks without affecting the overall project, but if it is delayed at all it will delay the conducting of the promotional cost analysis activity.

The pricing strategy and the the conducting of the promotional cost analysis activities can be delayed for their total slack times without delaying any other activities, as their total slacks and free slacks are equal.

(c)

Critical Path: C-E-F-G-H

For this project, the design of the product must be completed before the manufacture of the prototype models. In turn, those models must be completed before the product cost analysis, final pricing analysis, and market test activities can be completed.

This project appears to be dominated by the design, manufacture, and test of the product, which makes sense. Strategies and market analyses are useful, but ultimately worthless without a product to sell.
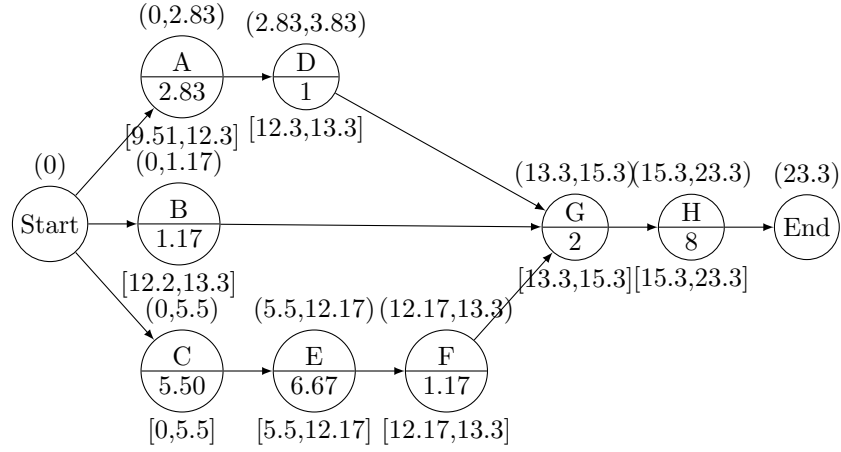
(d)

Gantt Chart for 9.19
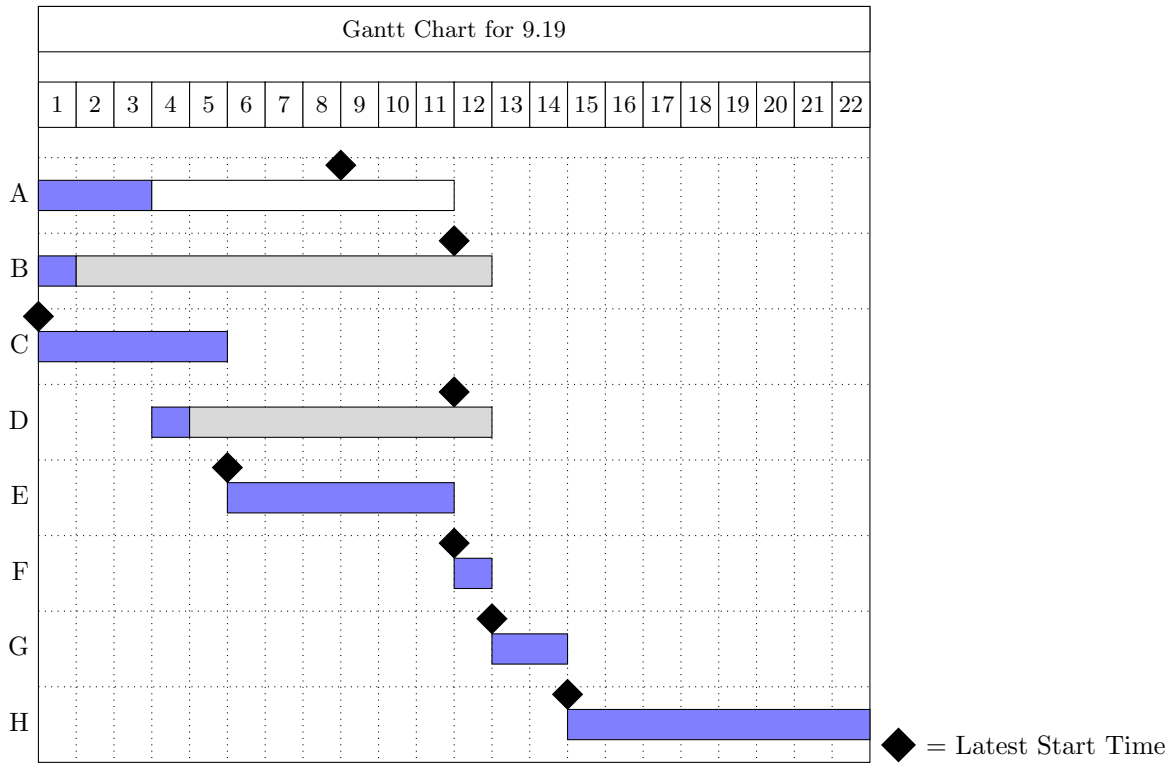
Problem 9.20

(a)

Table 3: Calculated Mean and Standard Deviation

Activity	Time estimate (weeks)			Mean	Std. Dev.
	Optimistic	Most likely	Pessimistic		
A	1	3	4	2.83	0.5
B	1	1	2	1.17	0.17
C	4	5	9	5.50	0.83
D	1	1	1	1	0
E	4	6	12	6.67	1.33
F	1	1	2	1.17	0.17
G	1	2	3	2.0	0.33
H	6	8	10	8.0	0.67

4

(b)

Table 4: Slacks for Buying Tom Cruise a Boat

Activity	Total Slack Eq LS - ES	Total Slack	Free Slack Eq Min$\{ES_{Suc}\}$ - EF	Total Slack
A	9.51-0=	9.51	2.83-2.83=	0
B	12.2-0=	12.2	13.3-1.1=	12.2
C*		0		0
D	12.3-2.83=	9.51	13.3-3.83=	9.51
E*		0		0
F*		0		0
G*		0		0
H*		0		0

* = On the Critical Path

(c)

Critical Path: C-E-F-G-H
Critical Path Mean Duration: 23.3 weeks
Critical Path Standard Deviation: $[0.83^2 + 1.33^2 + 0.17^2 + 0.33^2 + 0.67^2]^{1/2} = 1.75$

The critical path activities have not changed, but the expected total duration has increased to 23.3 weeks from 22 weeks.

(d)

(1)

$$P\left(Z \leq \frac{22 - 23.3}{1.75}\right) = P(Z \leq -0.743) = 1 - P(Z \leq 0.743) = 1 - 0.7704 = 0.23$$

There is a 23% chance that the project will be completed in 22 weeks or less.

(2)

$$P\left(Z \le \frac{23.3 - 23.3}{1.75}\right) = P(Z \le 0) = 0.50$$

There is, by definition, a 50% chance that the project will be completed in the mean time.

(3)

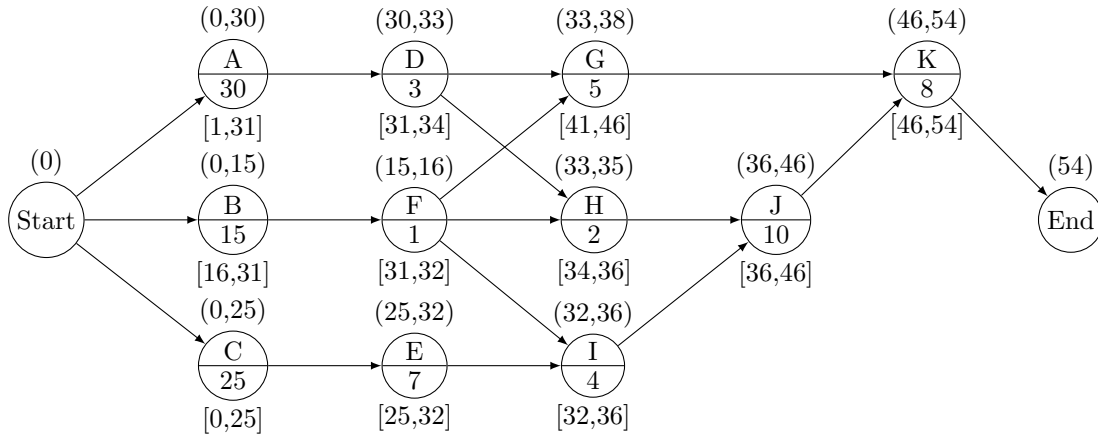$$P\left(Z \ge \frac{26 - 23.3}{1.75}\right) = 1 - P(Z \le 3.83) \cong 1 - 0.99999 \approx 0$$

There is a near-zero chance the project will take longer than 30 weeks.

$$P\left(Z \ge \frac{30 - 23.3}{1.75}\right) = 1 - P(Z \le 1.54) = 1 - 0.9382 = 0.062$$

There is about a 6.2% chance the project will take longer than 26 weeks to complete.

Problem 9.22

(a)

(b)

Table 5: Slacks for Buying Tom Cruise a Boat

Activity	Total Slack Eq LS - ES	=	Total Slack	Free Slack Eq Min{ES$_{Suc}$} - EF	=	Total Slack
A	1-0	=	1	30-30	=	0
B	16-0	=	16	15-15	=	0
C*			0			0
D	31-30	=	1	33-33	=	0
E*			0			0
F	31-15	=	16	32-16	=	16
G	41-33	=	8	46-38	=	8
H	34-33	=	1	36-35	=	1
I*			0			0
J*			0			0
K*			0			0

* = On the Critical Path

The total slack means that the activity may be delayed from the early start by that amount of time without affecting the total project duration; the free slack is the amount of time the activity may be delayed without delaying any other activity in the project.

For this project, the construction of the module shell can be delayed for 1 day, the ordering of life support system and scientific experimentation package for 16 days, the wiring of the module for 1 day, the preliminary test of the life support system for 16 days, the installation of the life support system into the module for 8 days, and the installation of the scientific experimentation package into the module for 1 day without affecting the overall project.

The the construction of the module shell, ordering of life support system and scientific experimentation package, and the wiring of the module activities cannot be delayed at all without affecting other activities as their free slack is zero.

The preliminary test of the life support system, the installation of the life support system into the module, and the installation of the scientific experimentation package into the module may be delayed for their total slack times without delaying any other activities, as their total slacks and free slacks are equal.

This tells us, almost counter-intuitively, that life support systems and scientific experimentation systems are should not be the main priorities for this project.

(c)

Critical Path: C-E-I-J-K
The following activities are on the critical path and as such have no slack (must be started at their early start times and cannot be delayed without delaying the entire project):
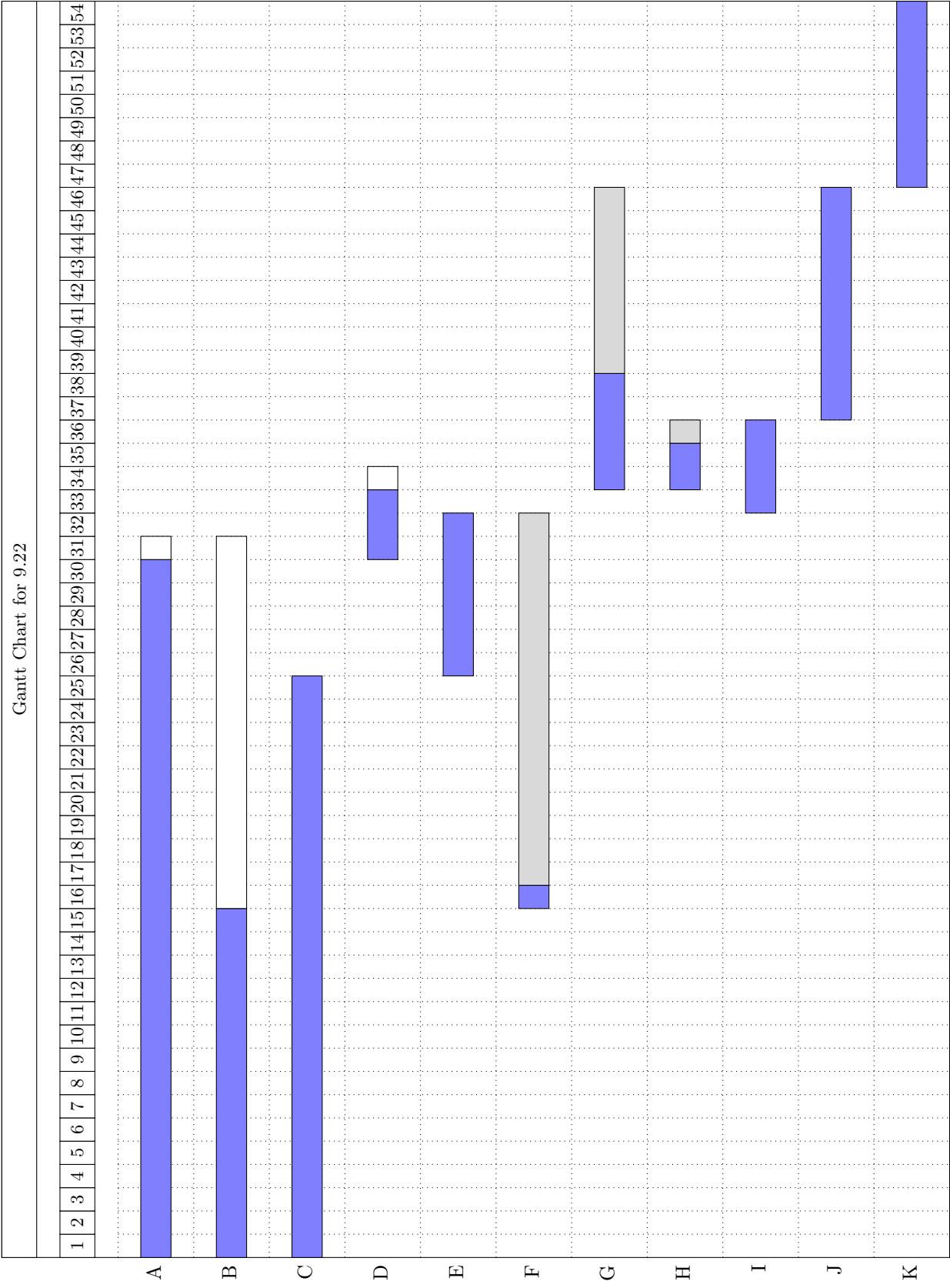
- Ordering components of control and navigation systems

- Assemble control and navigational system

- Preliminary test of control and navigational system

- Install control and navigational system in module

- Final testing and debugging

This tests us that the first priority must be the navigation and control systems.

(d)

See next page.

Gantt Chart for 9.22

Problem 9.23