

- (e) The average time an employee spends at the machine.
2. During an 8-hour work day, how many minutes does an employee spend at the machine? How much of that time is spent waiting in line? (**4 points**)
  3. Recall that Jack's business is thriving. Should he consider buying an additional machine? Explain your reasoning clearly. You can use reasonable assumptions to help you answer this question. (**3.5**)

## Trepani's Superstore

The Trepani Department store is having a Christmas sale (which will actually start December 20), and plans to send out an eight-page advertisement for it. This advertisement must be mailed out at least 10 days before December 20 to be effective, but various tasks must be done and decisions made first. The department managers decide which items on stock to put on sale, and buyers decide what merchandise should be brought in for the sale. Then a management committee decides which items to put in the advertisement and sets their sale prices. The art department prepares pictures of the sale items and a writer provides copy describing them. Then the final design of the advertisement, integrating words and pictures, is put together.

A mailing list for the advertisement is compiled from several sources, depending on the items put on sale. Then the mailing labels are printed. After the advertisement itself is printed, labels are attached, and the finished product, sorted by zip code, is taken to the post office.

Of course, all these operations take time. Unfortunately, it is already November 30 (**Pretend you got the CTP during last week's class.**), so only 20 days are available for the whole operation, including delivery. There is some concern whether the advertisements can be gotten out in time, and so estimates are made for the number of days needed for each task, based on past experience. These times are listed in Table 1.

<i>Task</i>	<i>Description</i>	<i>Time in Days</i>	<i>Preceding Tasks</i>
A	Choose items (department managers)	3	None
B	Choose items (buyers)	2	None
C	Choose and price items for ad	2	A,B
D	Prepare art	4	C
E	Prepare copy	3	C
F	Design advertisement	2	D,E
G	Compile mailing list	3	C
H	Print labels	1	G
I	Print advertisement	5	F
J	Affix labels	2	H,I
K	Deliver advertisements	10	J

Table 1: Trepani's timeline for Christmas Sale.

Alyssa is currently in her first year running the store entirely, and would like to know if it is possible to get the advertisements out in time for the sale. Initially, she has you to perform the following tasks to help in project.

1. Draw a project network to capture this problem. **(3 points)**
2. Using Excel, determine the earliest and latest start and finish times for each task. **(4 points)**
3. Prepare an activity schedule. **(3 points)**
4. Identify all the paths possible, and use that to highlight the critical tasks and path. **(4 points)**

After a review of your initial analysis, Alyssa has decided to share the information on Table 2 that you thought could help enhance your analysis.

<i>Task</i>	<i>Description</i>	<b>Task Completion in Days</b>		
		<i>Optimistic</i>	<i>Most Likely</i>	<i>Pessimistic</i>
A	Choose items (department managers)	2	3	6
B	Choose items (buyers)	2	2	2
C	Choose and price items for ad	2	2	2
D	Prepare art	2	4	7
E	Prepare copy	1	3	5
F	Design advertisement	2	2	2
G	Compile mailing list	1	3	5
H	Print labels	1	1	1
I	Print advertisement	2	5	8
J	Affix labels	1	2	3
K	Deliver advertisements	6	10	14

Table 2: Trepani's updated timeline for Christmas Sale.

1. Compute by hand the earliest expected completion time of project, identify critical tasks, critical path(s), and determine the variance of the project-completion time. **(10 points)**
2. Use Excel to verify your computations above. **(5 points)**
3. What is the probability of being finished within the 20 days? **(4 points)**
4. Alyssa has asked you to calculate the minimum number of days that have 90 percent chance of the all the mailings being delivered to customers. What is your answer? **(6 points)**

Being a determined businesswoman, Alyssa is willing to invest a little to get a successful Christmas sale on track for the year. She has collected some data and compiled them on Table 3 to find out how to get this project done. If she can get the mailings delivered by December 18, to give customers at least a week, she is confident of more than recouping the investment on shortening the process. In previous years, Trepani's Christmas sale has been a huge success and this year should not be any different, despite the somewhat late start to the process.

1. Formulate an appropriate crashing model to achieve a completion time by December 16. Show the project with activity on arc. **(10 points)**
2. Use Excel to determine which tasks should be shortened to achieve this goal and by how much? **(5 points)**

<i>Task</i>	<i>Normal Time</i>	<i>Normal Cost</i>	<i>Crash Time</i>	<i>Crash Cost</i>
A	3	1500	2	2500
B	2	1000	2	1000
C	2	1800	2	1800
D	4	2200	2	3200
E	3	1600	2	2000
F	2	800	2	800
G	3	450	1	900
H	1	1200	1	1200
I	5	1450	2	2050
J	2	450	1	900
K	10	1800	6	4500

Table 3: Trepani's cost (in \$) to shorten activities

3. How much will it cost to achieve this goal? (**2 points**)
4. Alyssa set a \$6,500 spending limit to get the project done by December 16. How soon can she get the advertisements mailed out? How would your formulation change to model this new condition? (**4**)