NAME (please print): **SOLUTION**

Excerpts from MAN-335 Exam #1
Fall 1998

Professor Edward Anderson
The University of Texas at Austin

Instructions:

- Count your pages. There should be 10 of them (including 2 charts).
- Closed-book, Closed-note exam, except for your one 8 ½" x 11" "crib sheet"
- Place your answers in the spaces provided
- Show all your work
- Make sure to print your name and social security number at the top of this page
- **DO NOT START UNTIL TOLD TO DO SO!**

You have one hour and 15 minutes to complete the exam. This is a long exam so use your time wisely. Write **concise (<25 word)** answers to the short-answer questions and do not spend your time composing award-winning essays.

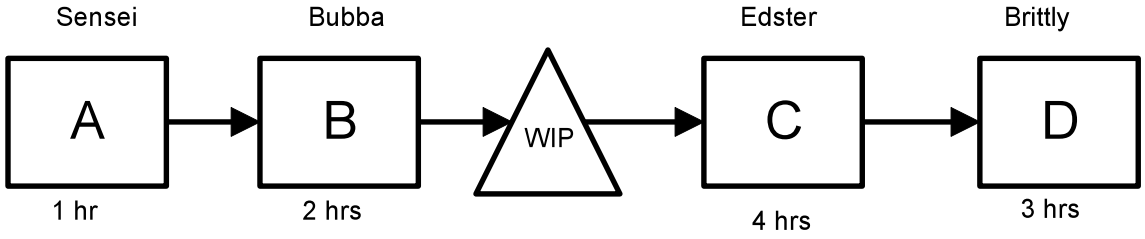
There are four questions worth a total of 100 points:

1) Multiple-choice questions (10 at 2.5 points each)
2) Short-answer questions (5 at 5 points each)
3) Process Flow Analysis Problem (25 points)
4) Project Management problem (25 points)

Good luck...

3) Some members of the operations management group have been hired to analyze a whole group of business problems for the Texas Widget Group. Instead of assigning each member a complete problem, they form a process instead, with each member concentrating on his specialty. The process flow diagram is shown below along with cycle times.

Being good OM-types, they realize that working as fast as possible is not necessarily a good thing for ROI. Instead they pace themselves to the bottleneck, so there is no overproduction in the steady-state. Note that the average WIP residence time is 8 hours, as Edster was a bit slow on start-up.



i) **What is the process cycle time and capacity and who is the bottleneck?** [3 pts]

Process CT= 4 hrs; Capacity = 1 problem/4hrs = 0.25 problems/hr; Bottleneck is Edster

ii) **What is the average utilization for the labor pool as a whole**? [7 points]

These people are PACED to the bottleneck, so:

Work done/ Work paid for = (1 hr/4 hrs + 2hrs/4hrs + 4hrs/4hrs + 3hrs/4hrs)/4 = 62.5%

iii) **What is the rush-order flow time? What is the flow-time (not counting any waiting in RMI)?** [5 points].

ROFT = sum of CTs = 1hr + 2hrs + 4hrs + 3hrs = 10 hrs

FT = sum of CTs + sum of waiting times = 1hr + 2hrs + 8 hrs + 4hrs + 3hrs =18 hrs. (The 8 hrs comes from the residence time in WIP stated in the instructions.)

iv) Suppose we could clone one individual and assign him to help out on the appropriate task. (For example, we could have a Bubba clone help out with Bubba's duties at Task B.) **Whom would we clone in order to speed up the process the most, and what would the new process cycle time be?** [5 points]

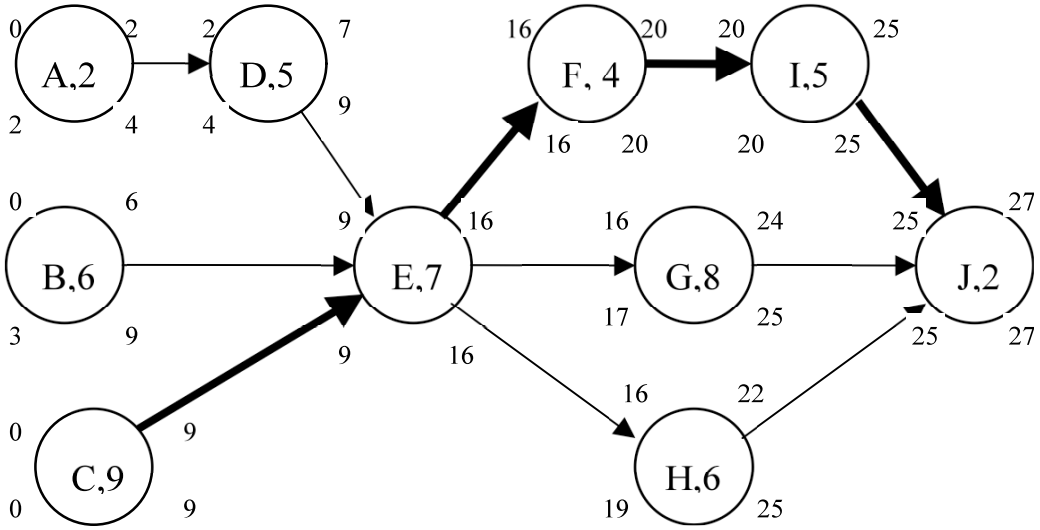
Cloning **Edster** reduces Operation C's CT to 2 hrs/job. Thus, the new bottleneck is Brittly, whose CT is 3 hrs/job. Thus, the process CT is now 3 hrs/job.

v) Returning to the original problem and ignoring what happened in problem iv, suppose instead that the Sensei were promoted and had to turn his duties over to Bubba. Bubba, however, takes twice as long to perform operation A as Sensei did, and Bubba still has to perform Operation B too. **What would the new process cycle time be, and where would we now have to add resources to improve it?** [5 points]

New CT(Bubba) = 2 * CT(Sensei) + OLD CT(Bubba)= 2 * 1 hr/job + 2 hrs/job = 4 hrs/job.

To improve the process, we need to add resources to BOTH Bubba AND Edster simultaneously.

4) The DMV has decided to try out a new design at the Lamar office. Your boss, an Aggie, has put you in charge and your current job is to schedule the implementation of this new design. It is critical to get these changes implemented as fast as possible, and with no hiccups, since the state legislature is considering privatizing the DMV. Any glitches will only reinforce the position of those advocating privatization. The appropriate activities, along with their duration information and precedence relationships, are shown below.



Complete the table below. [4 points]

Activity	a	m	b	Tbar	σ^2	slack
A	2	2	2	**2**	**0**	**2**
B	4	5	12	**6**	**1.778**	**3**
C	6	8	16	9	2.778	**0**
D	2	5	8	5	1.000	**2**
E	3	6	15	7	4.000	**0**
F	2	3	10	4	1.778	**0**
G	3	5	25	8	13.444	**1**
H	4	6	8	6	0.444	**3**
I	4	4	10	5	1.000	**0**
J	1	2	3	**2**	**0.111**	**0**

Calculate the expected project completion time. Identify the critical path. [4 points]

CP = CEFIJ

$\overline{T}_{CP} = \overline{T}_C + \overline{T}_E + \overline{T}_F + \overline{T}_I + \overline{T}_J = 27 days$

Note: $\sigma^2_{CP} = \sigma^2_C + \sigma^2_E + \sigma^2_F + \sigma^2_I + \sigma^2_J = 9.667 \text{days}^2$

In 28 days there will be a surge in DMV customers once the high-school students graduate from driving class. It is very important that the Lamar office be up and running by that time.

Determine the probability that the Lamar office will be ready in 28 days. [5 points]
(hint: Look only at the critical path)

$$\text{Prob}\,(T_{cp} < 28\,\text{days}) = \text{Prob}\left(Z < \frac{28\,\text{days} - \overline{T}_{cp}}{\sigma_{cp}}\right) = \text{Prob}\left(Z < \frac{28 - 27}{\sqrt{9.667}}\right) = 0.322 = 62.2\%$$

The state legislature wants to discuss privatization of the DMV. Thus it is essential to know the guaranteed project completion date. Your continued job depends upon not making an error here.

Determine the completion time of the Lamar office (to 99.9% probability. You can assume this is the +3-sigma point). [4 points]
(hint: look at the critical path and paths with similar mean and higher variance)

99.9% implies Z is 3.1 or approximately +3.0.

$$T_{CP}(99.9\%) = \overline{T}_{CP} + Z \bullet \sigma_{CP} = 27 + 3.0\sqrt{9.667} = 36.3 days$$
$$T_{CEGJ}(99.9\%) = \overline{T}_{CEGJ} + Z \bullet \sigma_{CEGJ} = 26 + 3.0\sqrt{20.33} = 39.5 days$$

Since in PERT, we always take the most pessimistic path result, we estimate the time of completion at 39.5 days.

An extra resource has become available that you can apply to either F, G, or H. Please determine for the questions below, which activity you would like to apply your resource to. Also determine whether you would like to reduce the expected duration or the standard deviation of the activity. (In either case the reduction will be 1 day. However, no calculations need be shown.)

Where would you apply the new resource if: [4 points]

(i) you wanted to reduce the expected duration of the project

F (expected duration reduction)

(ii) your highest priority was reducing the guaranteed completion date.
G's (Standard Deviation reduction)