

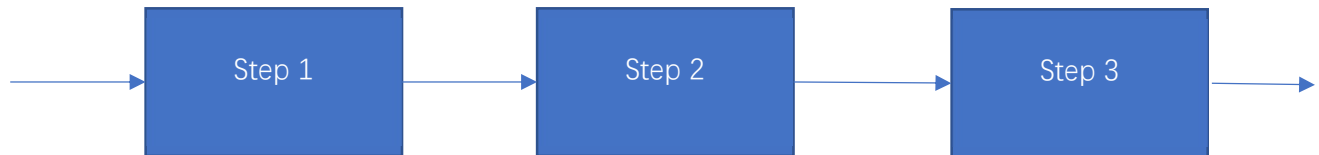
Homework 1

Problem 1. (5 points) Consider a process consisting of three steps:

Step	Processing time of each worker (min./unit)	Number of workers
1	10	2
2	6	1
3	16	3

Draw the process flow diagram for this process. What is the process capacity? What is the flow rate of the process if demand is eight units per hour? In this case, what is the cycle time? (Show your work to receive full credits.)

1: Draw the process flow diagram for this process.



2: What is the process capacity?

Process capacity

Step 1 $1 / 10 * 2 * 60 = 12$ units/hour

Step 2 $1 / 6 * 1 * 60 = 10$ units/hour

Step 3 $1 / 16 * 3 * 60 = 11.25$ units/hour

3: What is the flow rate of the process if demand is eight units per hour?

Because 8 units/hour < 10 units/hour, the flow rate of the process is 8 units/hour.

4: In this case, what is the cycle time?

The cycle time = $1 / \text{flow rate} = 0.125$ hour/unit

Problem 2. (12 points) Consider a process with three stations, ordered in sequence: A, B, and C. At each station, two consecutive tasks are performed and a worker performs both tasks. The processing time (in seconds per unit) it takes for a single person to complete each task and the number of workers at each station are given in the table below. For example, Station A has two workers who work in parallel. Worker 1 performs both A1 and A2 and so does worker 2. It takes a worker 10 secs to finish Task A2 per unit. Answer the following questions. (Show your work to receive full credits.)

Station	# of Workers	Task A1	Task A2	Task B1	Task B2	Task C1	Task C2
A	2	20	10	-	-	-	-
B	1	-	-	5	15	-	-
C	1	-	-	-	-	10	5

- (4 points) What is the capacity of this process (in units per minute)?
- (5 points) Design a production schedule that achieves the capacity of the process. Draw the Gantt chart of your schedule for two units of product. Based on your Gantt chart, what is the average flow time per unit?
- (3 points) Suppose that one worker in Station A is moved to Station B. What is the capacity of the new process?

1:

Process capacity

Station A $1 / (30 / 60) * 2 = 4 \text{ units/min}$

Station B $1 / (20 / 60) * 1 = 3 \text{ units/min}$

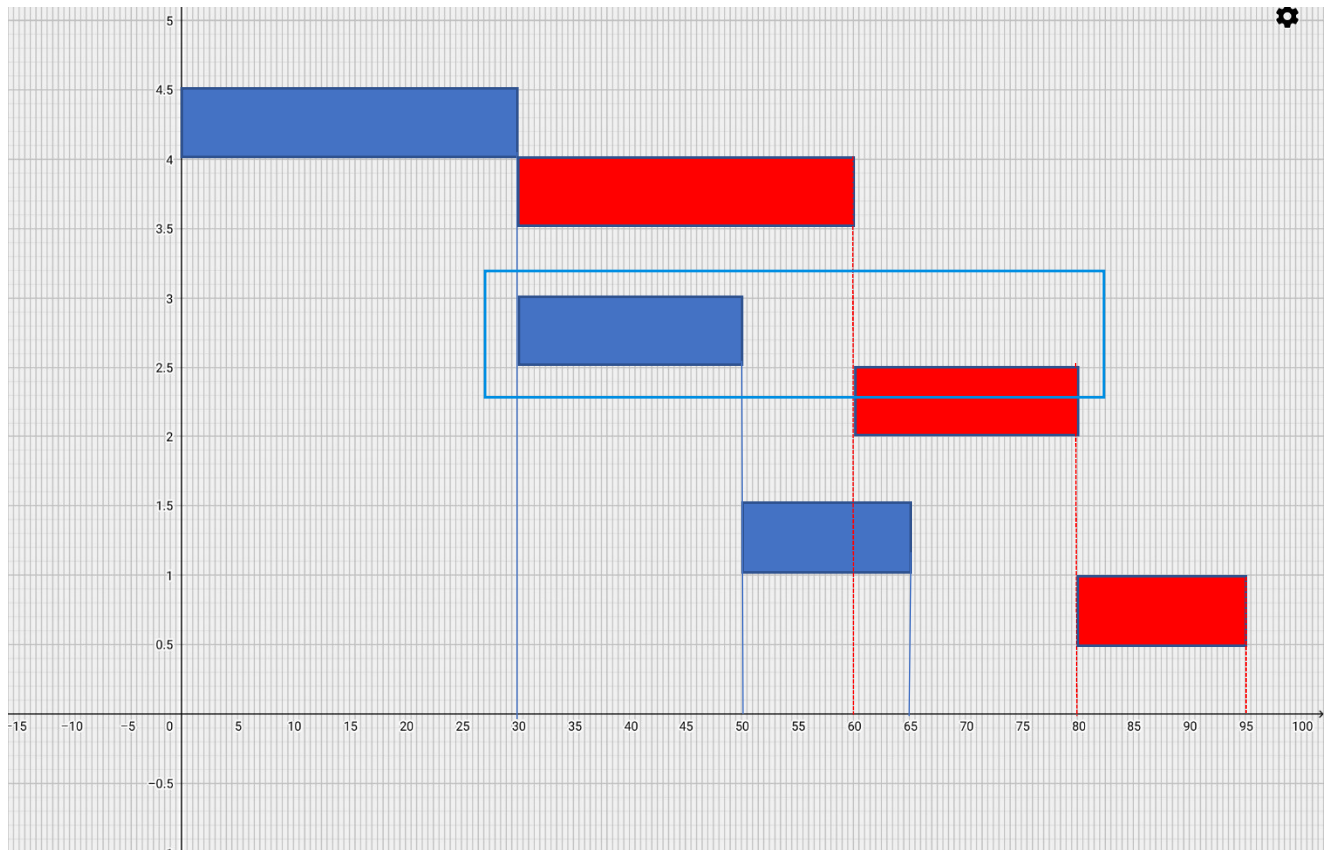
Station C $1 / (15 / 60) * 1 = 4 \text{ units/min}$

2:

The production schedules:

Start a new batch every 30 s, alternating between the two Station A.

Label the resources clearly on the y-axis.



The average flow time = $(30 + 20 + 15) * 2 / 2 = 65$ S/Unit

3:

New Process capacity

Station A $1 / (30 / 60) = 2$ units/min

Station B $1 / (20 / 60) * 2 = 6$ units/min

Station C $1 / (15 / 60) * 1 = 4$ units/min

Problem 3. (3 points) LaSweet, a large-scale bakery in Cleveland, is designing a new production process for their packaged cookies. LaSweet wants to be able to make 2,000 cookies per hour and it takes 12 minutes to bake the cookies. How large an oven does the company need (measured in the number of cookies that can be baked simultaneously)?

1 hour = 60 mins

$1 / (12 / 60) = 5$ ovens/hour

The number of cookies that can be baked simultaneously = $2000 / 5$

= 400 cookies / oven