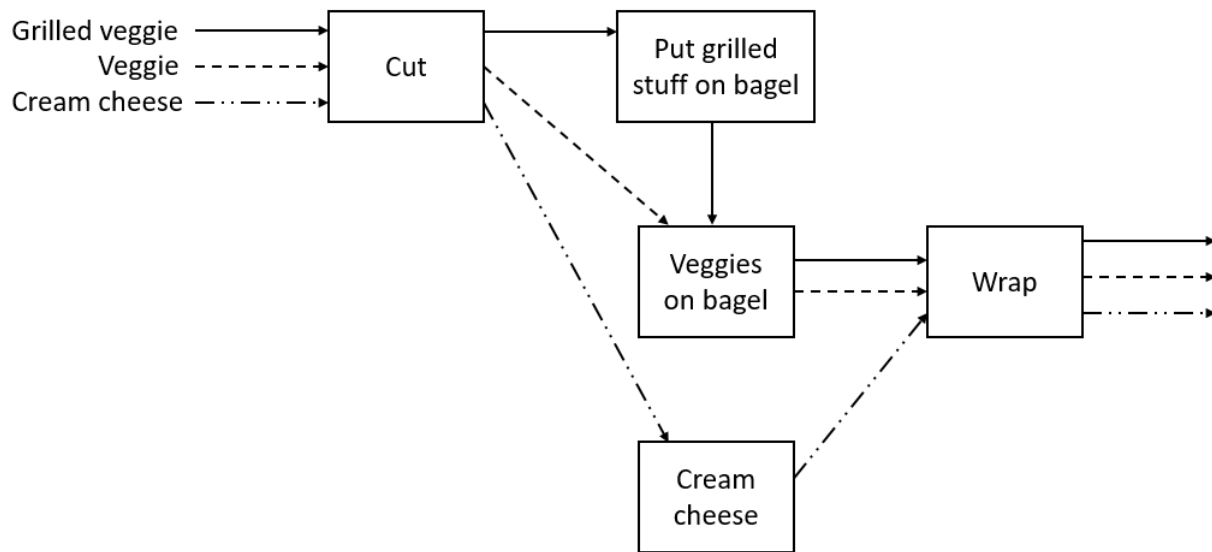


Homework 2

Problem 1. (14 points) The café at PBL sells three types of bagels that are produced according to the following process flow diagram. The café has a daily demand of 180 bagels, of which there are 30 grilled veggie, 110 veggie, and 40 cream cheese. Assume that each step in the process is staffed with one worker and that the café opens 10 hours per day.



The processing times at each step are independent of the bagel type and are given in the table:

	Cut	Grilled stuff	Veggies	Cream cheese	Wrap
Processing time [min/bagel]	3	10	5	4	2

Show your work to receive full credits.

1. (7 points) Which step is the bottleneck?
2. (3 points) How many bagels of each type can the process produce in one hour if the product mix must remain the same as the demand?
3. (4 points) Based on your answers in part 2, what are the utilizations of each step in the process?

1.

(1)

Activity	Resource	capacity min/h	Workload min/h	Implied τ min/h
Cut	1	60	54	0.9
grilled	1	60	30	0.5
veggies	1	60	70	1.167
Cream	1	60	16	0.267
Wrap	1	60	36	0.72

$$1.167 > (0.9, 0.5, 0.267, 0.72)$$

Veggies is the bottleneck.

(2):

Number of Cream cheese that can be produced in hour = $4 * (12 / 14) = 3.43$

Total process input = $12 + 3.43 = 15.43$

Number of Grilled veggies bagels produced per hour = $(3 / 18) * 15.43 = 2.57$

Number of Veggies bagels produced per hour = $(11 / 18) * 15.43 = 9.43$

Number of Cream cheese bagels produced per hour = $(4 / 18) * 15.43 = 3.43$

(3):

Activity	Resource	capacing	Utilization
Cut	1	60	$\frac{15.43}{20} = 0.77$
grilled	1	60	$\frac{2.57}{6} = 0.43$
veggies	1	60	$\frac{12}{12} = 1$
Cream	1	60	$\frac{3.43}{15} = 0.23$
Wrap	1	60	$\frac{15.43}{30} = 0.51$

Problem 2. (16 points) Consider the Kristen's Cookie Company (KCC). Suppose that the sequence of processing stages stays the same, but the duration of some of the process steps has changed. The sequence of steps and their duration are as follows:

Mixing	5 minutes of labor time for 1 dozen cookies; 6 minutes of labor time for 2 dozens of same-type cookies; 7 minutes of labor time for 3 dozens of same-type cookies;
Spooning	2 minute of labor time per dozen cookies;
Baking	15 minutes of oven time per dozen cookies: 1 minute of labor time to set up and load the oven followed by 14 minutes of baking;
Cooling	4 minutes;
Packing	2 minutes of labor time per dozen cookies;
Payment	2 minutes of labor time per order.

Unlike the case – Kristen will mix and pack; the roommate will spoon, set up and load the oven, and accept payment. The roommate will also unload the oven but we shall assume that this activity consumes negligible time and can be performed in the middle of doing something else. Furthermore, assume that three identical ovens are available for your use. Ignore the mixer in your analysis for simplicity.

Consider two scenarios: (i) each customer's order is for one dozen cookies, and (ii) each customer's order is for two dozen cookies of the same type. Answer the following questions. *Show your work to receive full credits.*

1. (8 points) Identify the bottleneck and find the process capacity (in dozens per hour) under scenarios (i) and (ii), respectively.
2. (4 points) Consider scenario (i) only. What is the process capacity (in dozens per hour) if the roommate is not available and one of the three ovens breaks down?
3. (4 points) Consider scenario (ii) only. What is the rush-order flow time for an order (in minutes)? Draw the Gantt chart.

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Resource	Activity	CAP (doz / hr)	
		1. doz. Order	2 doz Order
Kristen	Mix	$\frac{60}{5+2} = \frac{60}{7}$	$\frac{60}{6+2+2} = 12$
	Packing		
Oven	baking	$\frac{60 \times 3}{15} = 12$	$\frac{60}{15} \times 3 = 12$
Roomate	Spooning		
	payment	$\frac{60}{2+2+1} = 12$	$\frac{60 \times 2}{1 \times 2 + 2 \times 2 + 2} = 15$
	Oven load		
Mixer	Mixing	$\frac{60}{5} = 12$	$\frac{60}{6} \times 2 = 20$

i: The bottleneck is Kristen, capacity is 60/7 doz per hour

ii: The bottleneck is Kristen and oven, capacity is 12 doz per hour

(2)

Resource	Activity	Processing Time	Cap (doz/h)
Kristen	Mix, packing Oven load	60	$\frac{60}{5+2+2+2+1} = 5$
Oven	baking	60×2	$\frac{60 \times 2}{15} \times 1 = 8$
Mixer	mixing	60	$\frac{60}{5} = 12$

processing capacity = 5

(3):

