

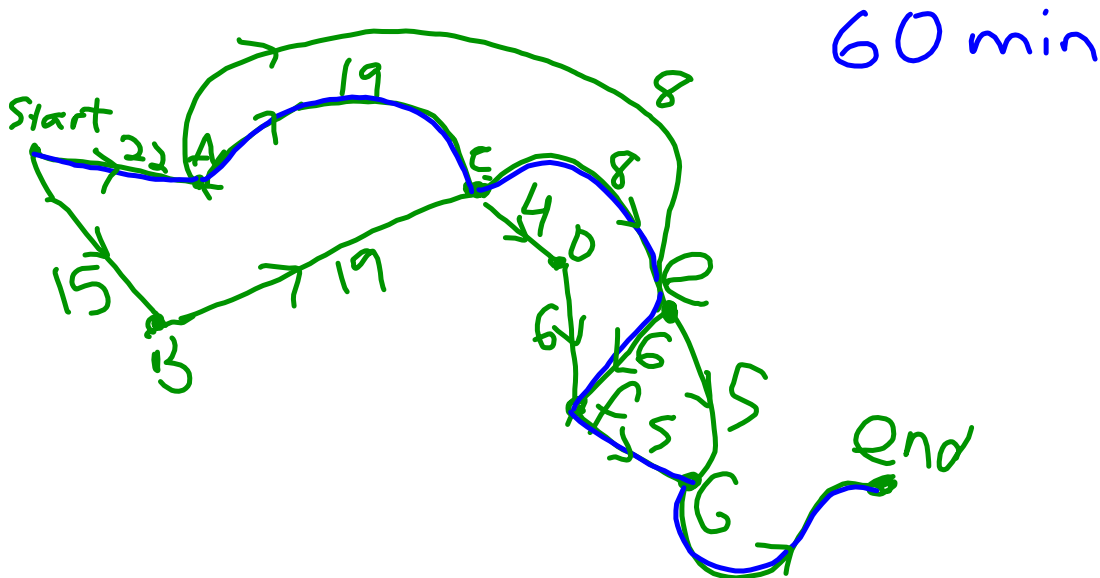
## MARKING: FOR TEACHER USE ONLY

Criterion 1	Shows understanding of the situational problem	40	36	32	28	24	20	16	12	8	4	0
Criterion 2	Uses mathematical knowledge that is applicable to the situational problem	40	36	32	28	24	20	16	12	8	4	0
Criterion 3	Develops an appropriate solution to the situational problem and shows clear procedures and steps, final results and a conclusion						20	16	12	8	4	0
Criterion 4	Shows appropriate validation of the steps in the solution											

Gatineau Toy Company produces robot toys and a type of a dice game made out of wood called The Challenger Board. The steps necessary to build these two lines of toy production are summarized in the table and the graph below.

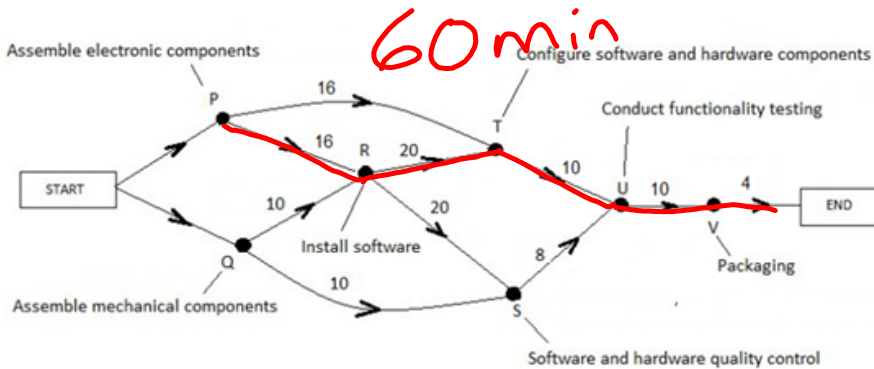
**PRODUCTION PROCESS OF A CHALLENGER BOARD**

Steps	Description	Duration in minutes	Prior steps
A	Cutting the challenger board	22	None
B	Cutting the dice	15	None
C	Painting and drying the board and the dice	19	A and B
D	Testing the dice	4	C
E	Preparing the board frame	8	A and C
F	Polishing the board and the dice	6	D and E
G	Packaging	5	E and F



**PRODUCTION PROCESS OF A ROBOT**

Each step is measured in minutes. The production time needed to carry out a step is inversely proportional to the number of employees involved in that step. In other words, the greater the number of employees working on a given task, the shorter the time needed to complete that task. For example, if it takes 40 minutes to carry out a task executed by one employee, then it will take 20 minutes to carry out the same task executed by two employees.



Each step is initially handled by two employees regardless of the production line. A marketing analyst suggested that to effectively monitor the production of toys and to better control the finances of the Gatineau Toy company, the following constraints must be taken into account:

- 1) The company must produce at most three times as many challenger boards as robots weekly.  $\leq 3x$
- 2) To avoid overstocking, the company cannot produce more than 280 toys per week.  $\leq$
- 3) The weekly minimum number of challenger boards and robots produced depends on the minimum time required to make each individual product during the production process. On good days, the company produce more toys than the weekly minimum numbers required. A week of production extends for a period of 5 working days, 8 hours a day.  $5 \cdot 8 = 40$  hours

A challenger board costs \$80 to make and a robot costs \$200 to build.

$X = \#$  of robots

$Y = \#$  of boards

$$1) Y \leq 3X$$

$$2) X + Y \leq 280$$

$$3) X > 40$$

$$Y > 40$$

a) Determine how many robot toys and challenger board toys must be produced to maximize the profit of the company in the current week, given that a challenger board and a robot sell respectively for \$180 and \$480, taxes included.

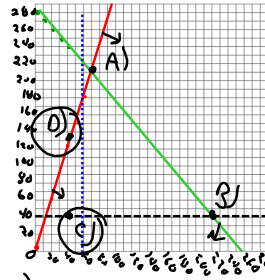
$$y \leq 3x + 0$$

$$x + y \leq 280$$

$$y \leq -x + 280$$

$$y > 40$$

$$x > 40$$



A)  $y = 3x$   
 $y = -x + 280$   
 $3x = -x + 280$   
 $4x = 280$   
 $x = 70$   
 $y = 3(70)$   
 $y = 210$   
 [70, 210]

B)  $y = -x + 280$   
 $y = 40$   
 $40 = -x + 280$   
 $x = 280 - 40$   
 $x = 240$   
 [240, 40]

C)  $x = 40$  [40, 40]  
 $y = 40$

D)  $y = 3x$   
 $x = 40$   
 $y = 3(40)$   
 $y = 120$   
 C) [64, 40] [40, 120]  
 $y = 3(64)$   
 $= 192$

Robot sells: 480\$  
 Robot cost: -200\$ R  
 Robot revenue: 280\$

Board sells: 180\$  
 Board cost: -80\$  
 Board revenue: 100\$

Vertices	$R = 280x + 100y$
[70, 210]	40,600\$
[64, 40]	15,200\$
[40, 40]	21,920\$
[240, 40]	71,200\$
[64, 120]	23,200\$
[40, 120]	37,120\$

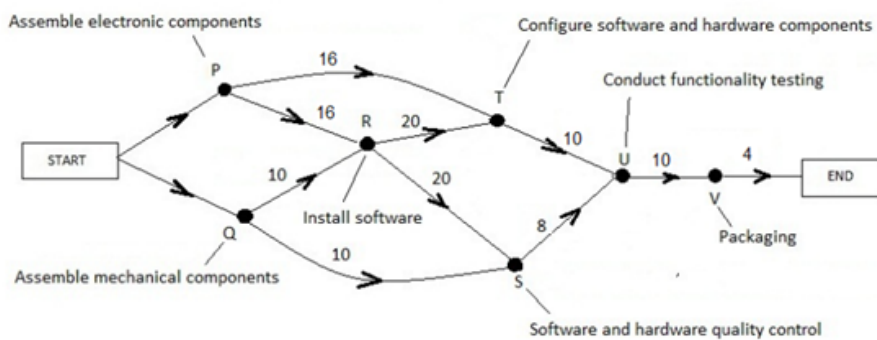
$$21920 - 15200 = 6720\$$$

- b) In anticipation for future growth, the company decided to make more robots next week. As a result of this decision, Gatineau Toy hired eight more employees: six will join the existing Software Installation team and two will be working with the Software and Hardware Component Configuration team. A new packaging machine will also be used. It will reduce the packaging time by 3 minutes regardless of the number of employees involved in that department. **Determine the minimum revenue increase of the company between this week and next week.**

1

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