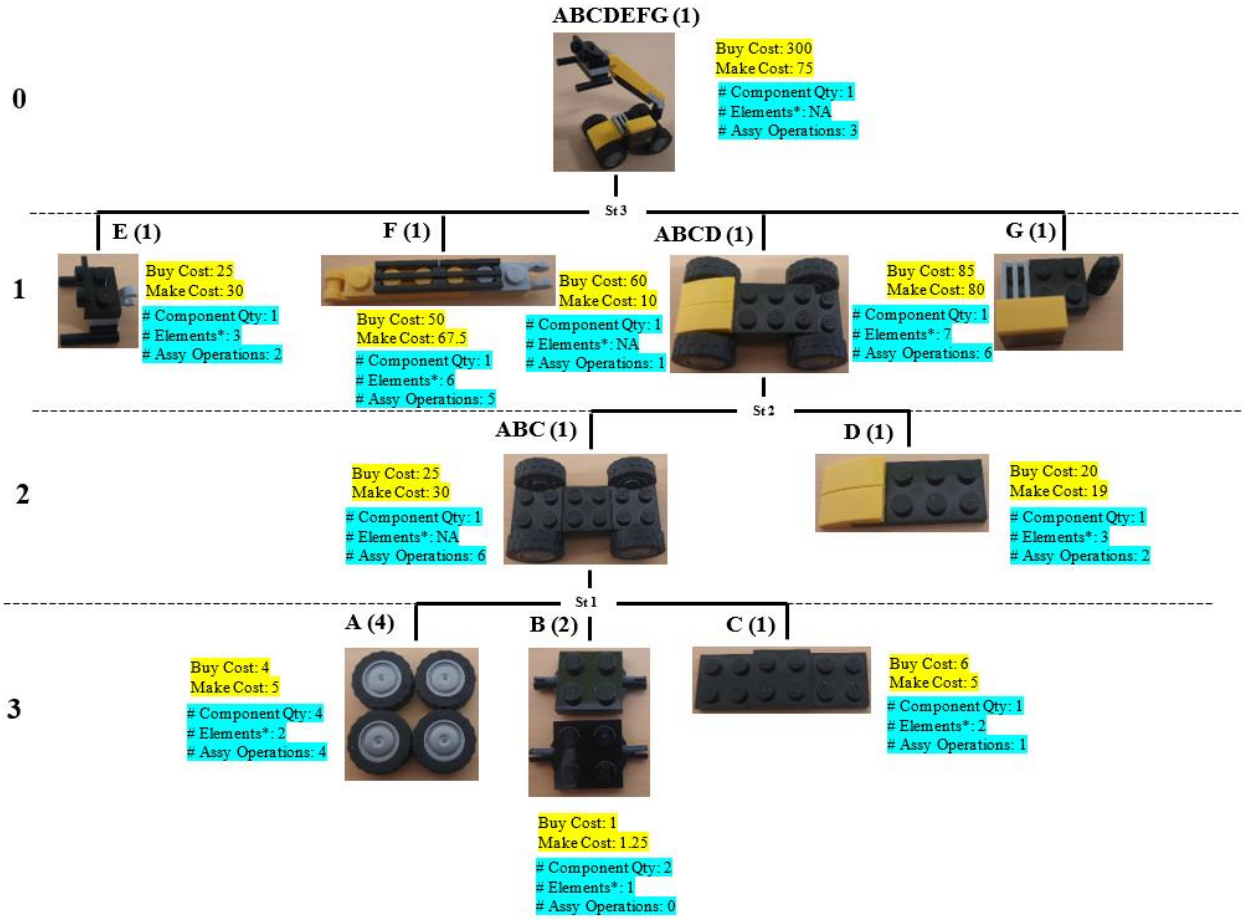
IE7200 2ndPE Take-home Project Description

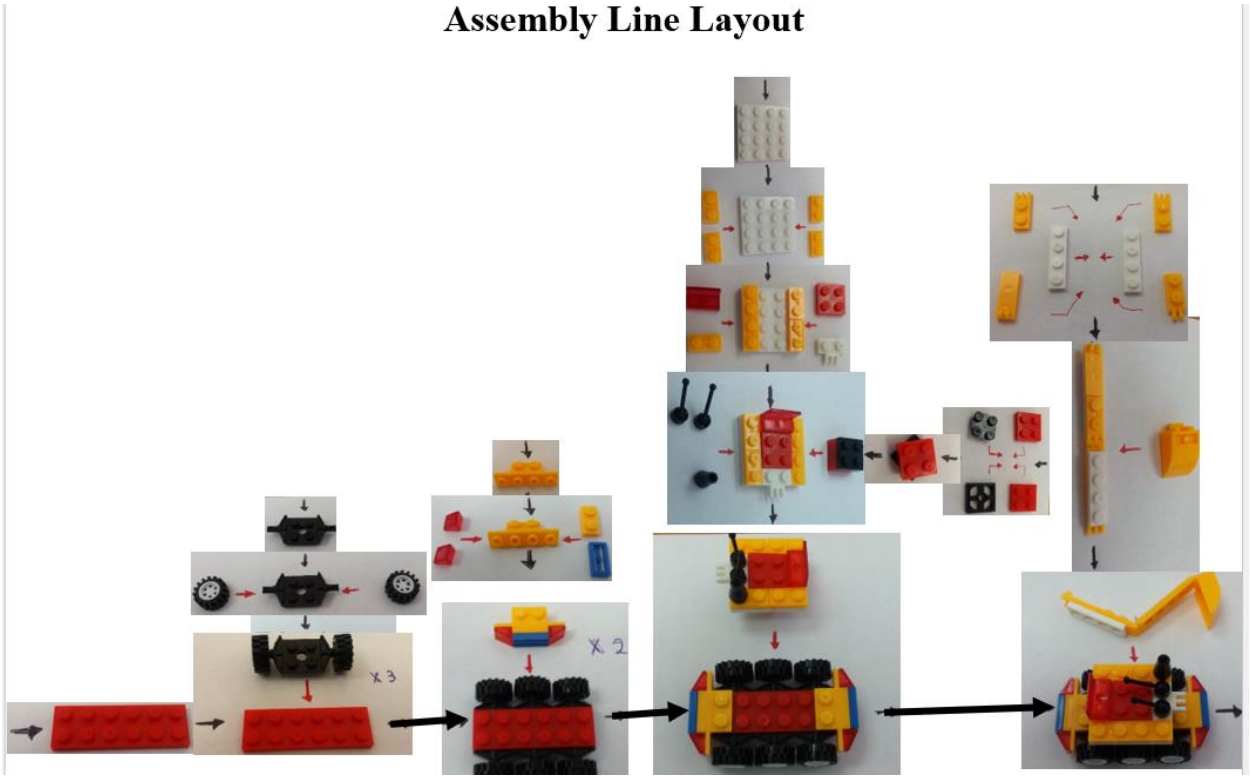
1.- Develop a Bill-of-Material (BOM) tree for the LEGO Truck that you selected to build:

- Make sure that your BOM uses seven (7) starting components
- Distribute those seven (7) starting components in BOM levels 0,1,2 or 0,1,2,3

2.- Use a similar graphic format (see below) to present the developed BOM tree:



3.- Use the develop BOM tree to establish a proposal (see below) for an Assembly Line Layout:



4.- For each of the items present in the developed BOM tree, calculate the Make cost***, using the following data:

- Element cost:
  - in Level 3 ➔ $1.25/Element
  - in Level 2 ➔ $3/ Element
  - in Level 1 ➔ $5/ Element
- Assy Operation:
  - in Level 3 ➔ $2.5/Assy Operation
  - in Level 2 ➔ $5/Assy Operation
  - in Level 1 ➔ $7.5/Assy Operation
- Assy Operation cost at any St i:
  - in Level 3 ➔ $5/Assy Operation
  - in Level 2 ➔ $10/Assy Operation
  - in Level 1 ➔ $25/Assy Operation
- Buy cost:
  - in Level 3 ➔ 80% of the calculated Make Cost, i.e. if the calculated Make Cost of a particular Component is $5, then the Buying Cost = 0.8 * 5 = $4
  - in Level 2 ➔ 115% of the calculated Make Cost, i.e. if the calculated Make Cost of a particular Component is $20, then the Buying Cost = 1.15 * 20 = $23
  - in Level 1 ➔ 90% of the calculated Make Cost, i.e. if the calculated Make Cost of a particular Component is $60, then the Buying Cost = 0.9 * 60 = $54

Make cost*** ➔ make sure to use the cost calculation logic presented in Appendix A

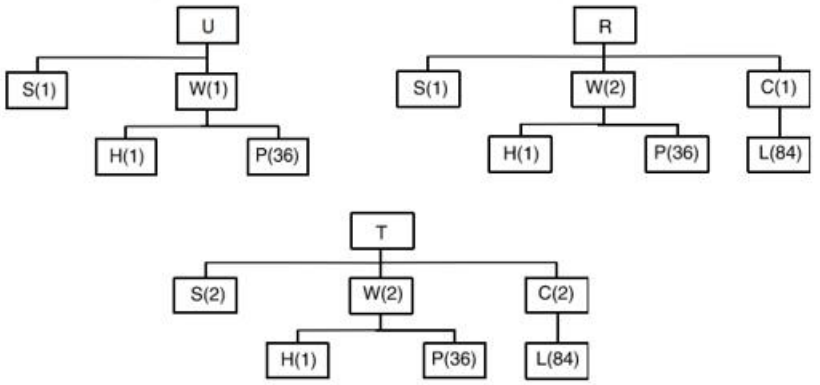
5.- For the developed BOM tree, formulate (and solve) the corresponding LP model*** of the One-Period MRP problem (see below):

- Use the calculated Make and Buying Costs here

11.5.3 Example: A One-Period MRP Problem

The Schwindle Cycle Company makes three products: Unicycles (*U*), Regular Bicycles (*R*), and Twinbikes (*T*). Each product is assembled from a variety of components including: seats (*S*), wheels (*W*), hubs (*H*), spokes (*P*), chains (*C*), and links (*L*). The full bills of materials for each product are shown below. The numbers in parentheses specify how many units of the child are required per parent:

Figure 11.6 MRP Structure for Bicycles



Current inventories are zero. Schwindle needs to supply 100 Unicycles, 500 Regular bicycles, and 200 Twinbikes. Finished products and complete sub-assemblies can be either manufactured or bought at the following prices:

Item:	U	R	T	S	W	C	H	P	L
Bought Price:	2.60	5.2	3.10	0.25	1.40	0.96	0.19	0.07	0.05
Assembly Cost:	1.04	1.16	1.90	0.20	0.22	0.26	0.16	0.04	0.03

6.- Present the obtained results and make the proper interpretation of the logic behind these last (see Appendix B for an example of how to proceed)

APPENDIX A

		Buy		Make				
Component	Qty.	Cost	Total	Cost	Total	Minimum	Decision	
A	4	4.00	16.00	5.00	20.00	16.00	Buy A	
B	2	1.00	2.00	1.25	2.50	2.00	BuyB	23.00 ==> ABC
C	1	6.00	6.00	5.00	5.00	5.00	Make C	

Element cost in Level 3
($1.25/Element)

Assy Operation cost in Level 3
($2.5/Assy Operation)

Component	Qty.	# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
A	4	2	4	1.25	10	2.5	10	20	5
B	2	1	0	1.25	2.5	2.5	0	2.5	1.25
C	1	2	1	1.25	2.5	2.5	2.5	5	5

Component		Cost	Total	Cost	Total	Minimum	Decision		
ABC	1	25.00	25.00	30.00	53.00	25.00	Buy ABC	44.00	==> ABCD
D	1	20.00	20.00	19.00	19.00	19.00	Make D		

Assy Operation cost at any St i located in Level 3
($5/Assy Operation)

Component		# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
ABC	1	NA	6	NA		5	30	30	30
D	1	3	2	3	9	5	10	19	19

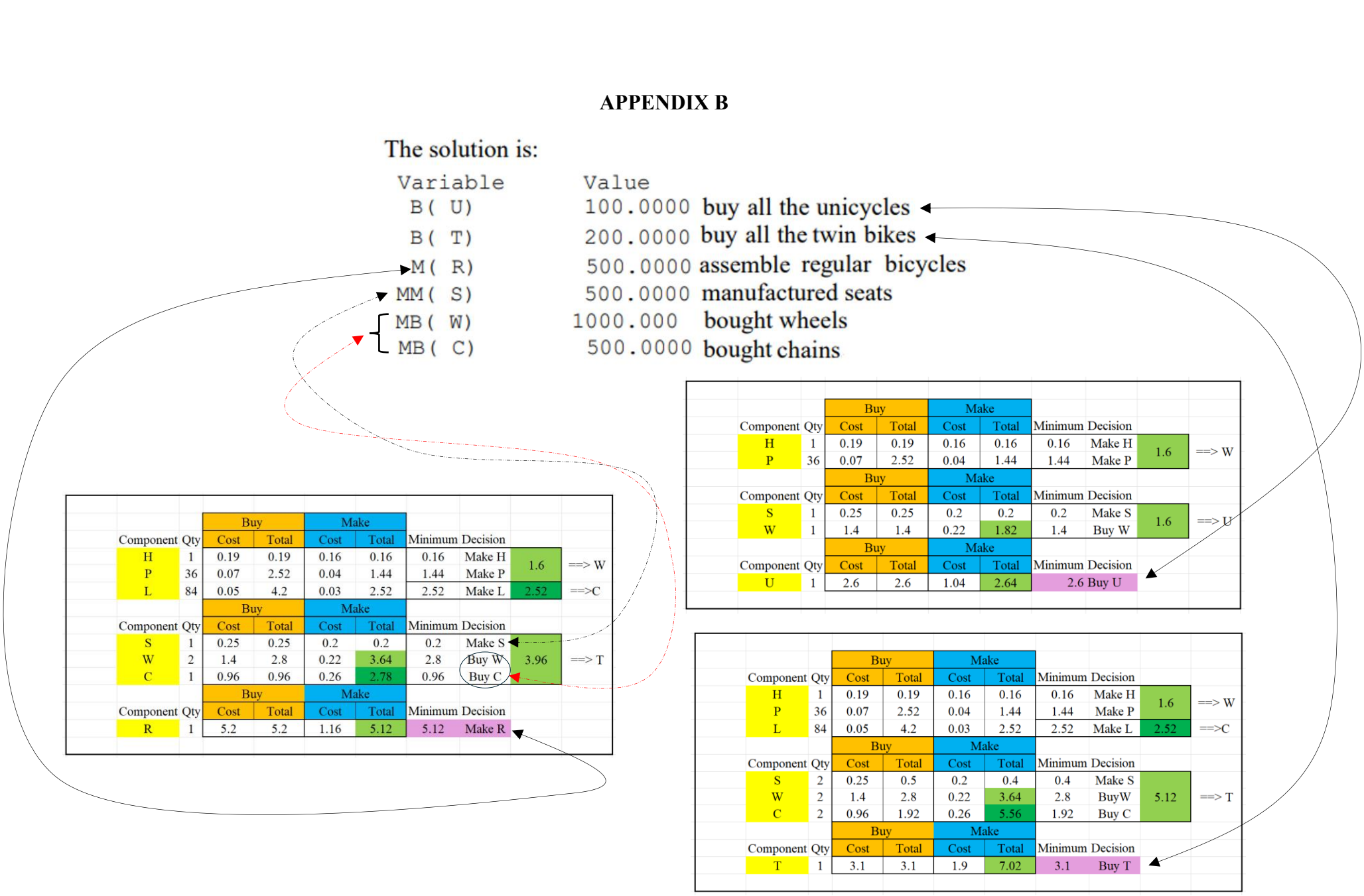
		Buy		Make					
Component	Qty.	Cost	Total	Cost	Total	Minimum	Decision		
A	4	4.00	16.00	5.00	20.00	16.00	Buy A		
B	2	1.00	2.00	1.25	2.50	2.00	BuyB	23.00	==> ABC
C	1	6.00	6.00	5.00	5.00	5.00	Make C		
		Buy		Make					
Component		Cost	Total	Cost	Total	Minimum	Decision		
ABC	1	25.00	25.00	30.00	53.00	25.00	Buy ABC	44.00	==> ABCD
D	1	20.00	20.00	19.00	19.00	19.00	Make D		
		Buy		Make					
Component		Cost	Total	Cost	Total	Minimum	Decision		
ABCD	1	60.00	60.00	10.00	54.00	54.00	Make ABCD		
E	1	25.00	25.00	30.00	30.00	25.00	Buy E	209.00	==> ABCDEFG
F	1	50.00	50.00	67.50	67.50	50.00	Buy F		
G	1	85.00	85.00	80.00	80.00	80.00	Make G		
		Buy		Make					
Component		Cost	Total	Cost	Total	Minimum	Decision		
ABCDEFG	1	300.00	300.00	75.00	284.00	284.00	Make ABCDEFG		

Component	Qty.	# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
A	4	2	4	1.25	10	2.5	10	20	5
B	2	1	0	1.25	2.5	2.5	0	2.5	1.25
C	1	2	1	1.25	2.5	2.5	2.5	5	5
Component		# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
ABC	1	NA	6	NA		5	30	30	30
D	1	3	2	3	9	5	10	19	19
Component		# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
ABCD	1	NA	1	NA		10	10	10	10
E	1	3	2	5	15	7.5	15	30	30
F	1	6	5	5	30	7.5	37.5	67.5	67.5
G	1	7	6	5	35	7.5	45	80	80
Component		# Elements	# Assy Operations	Raw Material Cost	Total	Assy Operation Cost	Total	Make Cost Total	Make Cost Total/Component
ABCDEFG	1	NA	3	NA		25	75	75	75

APPENDIX B

The solution is:

Variable	Value	
B(U)	100.0000	buy all the unicycles
B(T)	200.0000	buy all the twin bikes
M(R)	500.0000	assemble regular bicycles
MM(S)	500.0000	manufactured seats
MB(W)	1000.000	bought wheels
MB(C)	500.0000	bought chains



		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
H	1	0.19	0.19	0.16	0.16	0.16	Make H	1.6	==> W
P	36	0.07	2.52	0.04	1.44	1.44	Make P		
L	84	0.05	4.2	0.03	2.52	2.52	Make L	2.52	==>C
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
S	1	0.25	0.25	0.2	0.2	0.2	Make S		
W	2	1.4	2.8	0.22	3.64	2.8	Buy W	3.96	==> T
C	1	0.96	0.96	0.26	2.78	0.96	Buy C		
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
R	1	5.2	5.2	1.16	5.12	5.12	Make R		

		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
H	1	0.19	0.19	0.16	0.16	0.16	Make H	1.6	==> W
P	36	0.07	2.52	0.04	1.44	1.44	Make P		
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
S	1	0.25	0.25	0.2	0.2	0.2	Make S	1.6	==> U
W	1	1.4	1.4	0.22	1.82	1.4	Buy W		
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
U	1	2.6	2.6	1.04	2.64	2.6	Buy U		

		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
H	1	0.19	0.19	0.16	0.16	0.16	Make H	1.6	==> W
P	36	0.07	2.52	0.04	1.44	1.44	Make P		
L	84	0.05	4.2	0.03	2.52	2.52	Make L	2.52	==>C
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
S	2	0.25	0.5	0.2	0.4	0.4	Make S		
W	2	1.4	2.8	0.22	3.64	2.8	BuyW	5.12	==> T
C	2	0.96	1.92	0.26	5.56	1.92	Buy C		
		Buy		Make					
Component	Qty	Cost	Total	Cost	Total	Minimum	Decision		
T	1	3.1	3.1	1.9	7.02	3.1	Buy T		