Linear Programming, Computer solution - Product mix and sensitivity analysis

Admiral Motors can make trucks, cars, minivans, motorcycles, buses and airplanes. profits per unit are $12K, $9.8K, $10.5K, $2.4K $13K, and $9K, respectively. The most limiting resources are bench seats, steel, labor, wheels and headlights. The amounts--in numbers, tons and hours --used for each unit of each product is shown in the table. Oscar Optimizer, in the corner cubicle, has analyzed this situation using linear programming, and provided a simplified computer printout.

Computer Printout--the model

	trucks	cars	minivan	cycles	buses	planes		RHS=
Unit Profit-->	12	9.8	10.5	2.4	13	9		
constraint								
seats	1	2	4	0	16	2	<=	170
steel	3	1	2	0.2	4	0.5	<=	190
labor	1.5	1	1	0.5	3	3	<=	270
wheels	18	4	4	2	6	2	<=	550
lights	6	4	4	1	4	4	<=	180

A) What is the optimal production plan and what would the profit be for that plan?

B) How much could the profit on minivans drop before it would be worthwhile to change the plan?

C) Suppose someone offered $2 per hour for your labor? How many hours are you sure you should sell?

Computer Printout--Range of Optimality for Objective Function Coefficients

Variable	Value	Current Coefficient	Lower Limit	Upper Limit
trucks	0	12	-infinity	14.63
cars	0	9.8	-infinity	10.05
minivans	42.5	10.5	10.45	infinity
motorcycles	10	2.4	2.28	2.42
buses	0	13	-infinity	13.2
airplanes	0	9	-infinity	10.05

Objective Function Value = 470.250

D) Suppose someone offered to sell headlights for $2. How many are you sure you should buy?

E) How much would you have to charge for seats to make it worthwhile selling some?

F) How high could the profit on minivans go before you should change the plan?

Computer Printout--Range of Validity for Shadow Prices

Constraint	RHS	Slack	Shadow Price	Lower Limit	Upper Limit
benchseats	170	0	0.23	0	180
steel	190	103	0	87	infinity
labor	270	222.5	0	47.5	infinity
wheels	550	360	0	190	infinity
headlights	180	0	2.4	170	360

G) If everything else remained the same, how low could the profit on airplanes go before you would change the plan?

H) How would you arrive at these answers without Linear Programming models?

A)
42.5 minivans
10 motorcycles
OV=$470,250

B) lower limit is $10.45

C) labor has shadow price=$0 because we have some left over. We know we would at least sell the 222.5 hours of slack for any price >$0

D) Headlights have a value of $2.40 to us. we would buy until we have 360, that's 180 more than we have now, so buy 180. After that, we don't know the value of getting more.

E) Seats have a value of $230 to us, so we would have to get at least that before we would give any up.

F) It doesn't matter how high the profit on minivans goes, we can't make any more.We are limited by benchseats that aren't used on motorcycles, so it wouldn't do any good to cut back on motorcycles.

G) It doesn't matter. since we already aren't making any, a lower profit on airplanes would have no effect on the paln.

H) good question. What do you think?