1.What is the monthly profit and monthly production for each air conditioner type?

Micro - 152 quantity and 138533 Profit
Personal - 725 quantity and 949424 Profit
Residential - 1000 quantity and 1810000 Profit
Industrial - 459 quantity and 1014925 Profit

2.Run the sensitivity report. Which constraints are binding?

Following Constraints are binding:
Stamping hours, Welding hours, Assembly hours, Max residential Quantity

3.Only using the sensitivity report (do not change the value and re-run the model), would the optimal production plan change if the profit for each Micro air conditioner change to 1000? If your answer is yes, explain your reasoning. If your answer is no, what is the new monthly profit and explain your calculation.

Since the allowable increase for the profit per Micro air conditioner is $77.59, and the proposed increase to $1000 represents a change of $90, this exceeds the allowable increase. Therefore, the optimal production plan could change because the increase goes beyond the allowable range which could impact the solution's feasibility.

4. Only using the sensitivity report (do not change the value and re-run the model), would the optimal production plan change if the profit for each Residential air conditioner change to 1750? If your answer is yes, explain your reasoning. If your answer is no, what is the new monthly profit and explain your calculation.

No, the optimal production plan would not change if the profit for each Residential air conditioner changes to $1750. The allowable increase for the profit per unit is effectively infinite, so a decrease to $1750 from $1810 is well within this range and does not impact the optimality of the current solution.
The new monthly profit calculation, considering the change, is approximately 3852882. This reflects the decrease in unit profit for Residential air conditioners but maintains the same production quantities.

5.Only using the sensitivity report (do not change the value and re-run the model), can you determine the new objective function value without re-running the model if the number of hours available in the Stamping department change to 8050? If your answer is no, explain your reasoning. If yes, what is the new monthly profit and explain your calculation.

Given that the shadow price for the Stamping department is $82.3841 per additional hour, and considering that the increase in available hours is within the allowable range, I can calculate the impact on our monthly profit without needing to rerun the model. The increase of 50 hours in the Stamping department to 8050 is well within the allowable increase of 143.227 hours highlighted in the sensitivity report.
By multiplying the increased hours (50) by the shadow price ($82.3841), the total additional profit comes to $4,119.205. Therefore, the updated monthly profit, taking into account this adjustment, would be approximately $3,917,001.205. This figure is derived by adding the additional profit to our original profit of $3,912,882, demonstrating the direct relationship between increased capacity in the Stamping department and our total profit.

6.Only using the sensitivity report (do not change the value and re-run the model), can you determine the new objective function value without re-running the model if the number of hours available in the Welding department change to 9000? If your answer is no, explain your reasoning. If yes, what is the new monthly profit and explain your calculation.

No, we cannot determine the new objective function value without re-running the model if the number of hours available in the Welding department changes to 9000. This is because the proposed increase in hours (from 8000 to 9000, which is a 1000 hour increase) exceeds the allowable increase of 23.0657 hours specified in the sensitivity report. This means the shadow price is no longer valid beyond this allowable increase, and the impact on the objective function cannot be accurately predicted without re-optimizing the model under the new constraints.