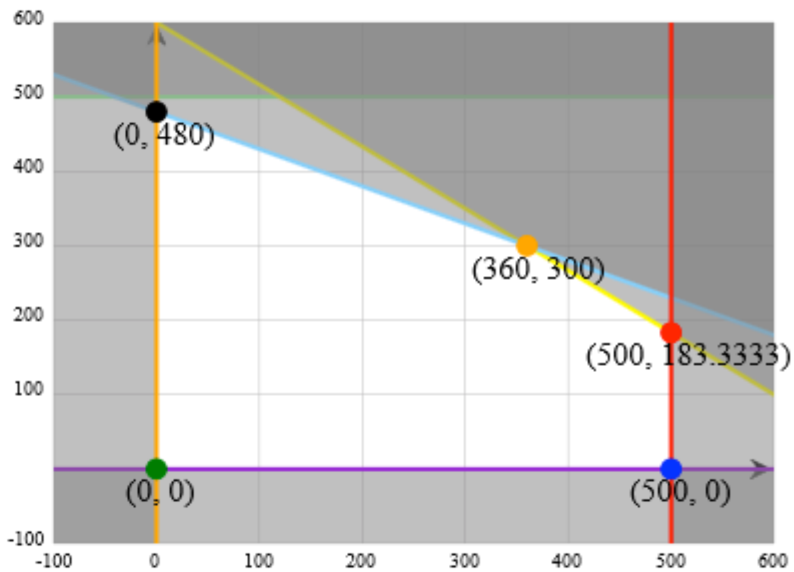
Homework.

Part 1.
Computer Implementation: Solve Wilson problem by the Lindo and compare the results with your graphical solution.

Graphical Solution is attached to email.

Lindo



The results of the Wilson problem are the same when comparing my graphical solution with Lindo's. The optimal values for the problem were found to be (360, 300), all of the constraints were followed and the feasible region was shown. The differences are that the Lindo solution also gave the 5 corner coordinates, and also provided the information for the RHS and OBJ Coefficient ranges.

Part 2.

Dark Side of LP

1.

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) -16.00000

VARIABLE VALUE REDUCED COST

X1	4.000000	0.000000
X2	0.000000	2.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	-4.000000
3)	2.000000	0.000000
4)	4.000000	0.000000
5)	0.000000	0.000000

NO. ITERATIONS= 1

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
X1	-4.000000	4.000000	INFINITY
X2	-2.000000	2.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	4.000000	INFINITY	4.000000
3	2.000000	INFINITY	2.000000
4	0.000000	4.000000	INFINITY
5	0.000000	0.000000	INFINITY

It is true that having an unbounded feasible range doesn't mean that a solution is unbounded, due to either a max or min solution restriction, but a unbounded solution means that an unbounded feasible range must exist or else the solution would have to end where the feasible range becomes bounded. This example shows that we are trying to maximize the value of the problem and although it could be any set of numbers, the maximum forces us to set a "soft" boundary on the unbounded solution, whereas if the maximize solution was positive, both the solution set and feasible region would be unbounded.

2.

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) 48.00000

VARIABLE	VALUE	REDUCED COST
X1	8.000000	0.000000
X2	0.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	8.000000	0.000000
3)	0.000000	2.000000
4)	8.000000	0.000000
5)	0.000000	0.000000

NO. ITERATIONS= 1

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
X1	6.000000	INFINITY	0.000000
X2	4.000000	0.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	16.000000	INFINITY	8.000000
3	24.000000	24.000000	24.000000
4	0.000000	8.000000	INFINITY
5	0.000000	0.000000	INFINITY

If the first coefficient had a rounding error of .01, then there would only be one solution as it is not possible to have .01 of any producible item, normally this would be considered waste if the other .99 couldn't be used, depending on what the product is. Depending on the product, they might need to add the other .99 to the .01 and write it off as waste, thus decreasing the overall maximize solution.

3.

Lindo will not supply an answer as it is infeasible. The reason it is infeasible is that the constraints are unrealistic for what is being asked. They want to at least product 4 of product x1 and 7 of product x2, but they can't use more than 8 of a certain constraint while needing 4 of the constraint to produce x1 and 2 to product x2. In this case either the suppliers are not willing to give enough material, the upper management is not being realistic with expectations or they underbid on a contract for production, which gave them these unrealistic constraints.

Part 3.

Multiple Unbounded

1.

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) 1200.000

VARIABLE	VALUE	REDUCED COST
X1	30.000000	0.000000
X2	0.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	10.000000	0.000000
3)	0.000000	10.000000
4)	30.000000	0.000000
5)	0.000000	0.000000

NO. ITERATIONS= 1

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
X1	40.000000	INFINITY	0.000000
X2	30.000000	0.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	40.000000	INFINITY	10.000000
3	120.000000	40.000000	120.000000
4	0.000000	30.000000	INFINITY
5	0.000000	0.000000	INFINITY

In this solution, there are not an infinite number of solutions. Although it may appear to be infinite, the resources for the red line are a maximum of 40 and the blue line has a maximum of 120. With the variables x1 and x2 having to be positive, there is a finite number of solutions.

2.

Lindo will not give an answer as it is an infeasible solution within the constraints provided. In order to have a feasible solution, the constraints on the Blue and Green line will have to be reduced to, at a minimum to X1, X2>=1. Otherwise at their current value constraints, there is no feasible solution.

3. Lindo says that the solution is unbounded at -3 and that there are an infinite number of solutions available. In order to get an optimal solution or just a finite set of solutions, there needs to be a resource limit per day, until a limit is to be put in, such as only being able to produce 1000 items per day, there will be no realistic or feasible solution.

Part 4.
Short Report of findings

1. I agree with the solution that is provided and the reasoning that it is the value that it is said to be. Lindo came up with the same solution as was provided as the solution. However, I disagree with his first constraint being .5x1 + .33x2 because mixture A should have been .5x1 + .5x2 as it was half-pound of cheeries and half-pound of mint, not half-pound of cheeries and one-third-pound of mint.
2. When completing example 2 in Lindo, I realized that the optimal solution was infeasible, not because of the values or constraints given, but because one business center cannot be open for 8.029 days and the other for 5.265 days.
3. Example 3 goes into the most detail as to how they found the optimal solution for the problem and the steps taken to get it. I found this to be the easiest to replicate as I was able to verify the given answer twice.