COSC 480/MATH 482
Midterm Problem Formulations
Fall 2012

Problem 1
This is my formulation, probably the most straightforward version.

Maximize: $Z = 320(x_{1f} + x_{1c} + x_{1b}) + 400(x_{2f} + x_{2c} + x_{2b}) + 360(x_{3f} + x_{3c} + x_{3b}) + 290(x_{4f} + x_{4c} + x_{4b})$
Subject To: $500x_{1f} + 700x_{2f} + 600x_{3f} + 400x_{4f} \leq 7000$
$500x_{1c} + 700x_{2c} + 600x_{3c} + 400x_{4c} \leq 9000$
$500x_{1b} + 700x_{2b} + 600x_{3b} + 400x_{4b} \leq 5000$
$x_{1f} + x_{2f} + x_{3f} + x_{4f} \leq 12$
$x_{1c} + x_{2c} + x_{3c} + x_{4c} \leq 18$
$x_{1b} + x_{2b} + x_{3b} + x_{4b} \leq 10$
With: $x_{1f}, x_{1c}, x_{1b}, x_{2f}, x_{2c}, x_{2b}, x_{3f}, x_{3c}, x_{3b}, x_{4f}, x_{4c}, x_{4b} \geq 0$

You could also add the following constraints:

$(x_{1f} + x_{2f} + x_{3f} + x_{4f})/12 - (x_{1c} + x_{2c} + x_{3c} + x_{4c})/18 = 0$
$(x_{1f} + x_{2f} + x_{3f} + x_{4f})/12 - (x_{1b} + x_{2b} + x_{3b} + x_{4b})/10 = 0$

But this does not really change the problem. Taking the formulation above, there is very little needed to go from standard to augmented, just adding slack variables $s_1, s_2, s_3, s_4, s_5, s_6$ to the 6 constraints. No adjustment is necessary to the objective function.

Problem 2

Augmented Formulation:

Maximize: $Z = (-M + 3)x_1 + 2x_2 - (M - 7)x_3 + Mx_5 + 20M$
Subject to: $-x_1 + x_2 + x_4 = 10$
$2x_1 - x_2 + x_3 - x_5 + x_6 = 10$
With: $x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$