The Diet Problem of the Cadet Wardroom

Rosemary Thyme, the Nutritionist for the Corps of Cadets at the U.S. Coast Guard Academy, prepares 30 dinner menus, one for each day of the month. The noon meal for Wednesday, January 22nd, consists of noodles, turkey divan, potato salad, beets, and congo bars. (Note: Also being served are sausage & peppers, asparagus, salad bar, banana gelatin, and "warned" French bread. Assumptions: Cadets will not eat: (1) Sausage & peppers because frankly the sausage & peppers do not really look like sausage & peppers; (2) Asparagus because it is asparagus; (3) Any of the salad bar items because that would require too much thought on what to put on their plate; (4) Banana gelatin because of the whole horse hoof thing, and (5) Warned French bread because the menu meant to say "warmed" French Bread but the clock orderlies kept warning everyone about the French bread. She has determined that this meal must provide 63,000 milligrams (mg) of protein, 10 mg of iron, 15 mg of niacin, 1 mg of thiamin, and 50 mg of vitamin C. Each 100 grams of these foods provides the amount of each nutrient and fat indicated in the following table:

NUTRIENT (mg / 100 grams)						
	Protein	Iron	Niacin	Thiamin	Vitamin C	Fat
Noodles	5,000	1.1	1.4	0.18	0.0	5,000
Turkey Divan	29,300	1.8	5.4	0.06	0.0	5,000
Potato Salad	5,300	0.5	0.9	0.06	10.0	7,900
Beets	3,000	2.2	0.5	0.07	28.0	300
Congo Bars	4,000	1.2	0.6	0.15	3.0	14,300

To avoid too much of one type of food, no more than 300 grams of noodles, 300 grams of turkey divan, 200 grams of potato salad, 100 grams of beets, and 100 grams of congo bars should be included in the meal. Knowing how smart the OR majors at the Academy are, Ms. Thyme has asked you to determine the composition of a meal that meets the nutritional requirements and provides the least amount of fat.

Let N, T, P, B, C = amount of Noodles, Turkey divan, Potato salad, Beets, and Congo bars, respectively, in a meal (in 100 g)

$$\text{minimize } z = 5000N + 5000T + 7900P + 300B + 14,300C \qquad (\text{total mg fat})$$

subject to

$$5000N + 29,300T + 5300P + 3000B + 4000C \geq 63,000 \qquad (\text{mg protein})$$
$$1.1N + 1.8T + 0.5P + 2.2B + 1.2C \geq 10 \qquad (\text{mg iron})$$
$$1.4N + 5.4T + 0.9P + 0.5B + 0.6C \geq 15 \qquad (\text{mg Niacin})$$
$$0.18N + 0.06T + 0.06P + 0.07B + 0.15C \geq 1 \qquad (\text{mg Thiamin})$$
$$10P + 28B + 3C \geq 50 \qquad (\text{mg Vitamin C})$$
$$0 \leq N \leq 3 \qquad (100 \text{ g noodles})$$
$$0 \leq T \leq 3 \qquad (100 \text{ g turkey divan})$$
$$0 \leq P \leq 2 \qquad (100 \text{ g potato salad})$$
$$0 \leq B \leq 1 \qquad (100 \text{ g beets})$$
$$0 \leq C \leq 1 \qquad (100 \text{ g congo bars})$$