

(Agricultural production planning problem) Margaret Black's family owns five parcels of farmland broken into a southeast sector, north sector, northwest sector, west sector, and southwest sector. Margaret is involved primarily in growing wheat, alfalfa, and barley crops and is currently preparing her production plan for next year. The Pennsylvania Water Authority has just announced its yearly water allotment, with the Black farm receiving 7,401 acre-feet. Each parcel can only tolerate a specific amount of irrigation per growing season, as specified in the following table:

Parcel	Acres	Water Irrigation Limit (Acre-Feet)
Southeast	2000	3200
North	2300	3400
Northwest	600	800
West	1100	500
Southwest	500	600

Each of Margaret's crops needs a minimum amount of water per acre, and there is a projected limit on sales of each crop. Crop data follow:

Crop	Maximum Sales	Water Needed per Acre (Acre-Feet)
Wheat	110,000 bushels	1.6
Alfalfa	1,800 tons	2.9
Barley	2,200 tons	3.5

Margaret's best estimate is that she can sell wheat at a net profit of \$2 per bushel, alfalfa at \$40 per ton, and barley at \$50 per ton. One acre of land yields an average of 1.5 tons of alfalfa and 2.2 tons of barley. The wheat yield is approximately 50 bushels per acre.

- a) Formulate Margaret's production plan.
- b) What should the crop plan be, and what profit will it yield?