LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

ERASE

1

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

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You have to select the amount of each type of timber.

ERASE

2

Lecture 28

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

You have to select the amount of each type of timber.

What are the types of timber?

ERASE

3

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

You have to select the amount of each type of timber.

What are the types of timber?

1) Furniture
2) Plywood
3) Pulpwood

ERASE

4

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

You have to select the amount of each type of timber.

What are the types of timber?

1) Furniture
2) Plywood
3) Pulpwood

ERASE

5

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

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x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

ERASE

6

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.

ERASE

7

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.

ERASE

8

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

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x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.

ERASE

9

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

ERASE

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Lecture 28

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

This must refer to the objective function.

ERASE

11

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

ERASE

12

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

These must be "limits" on constraints.

ERASE

13

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

$100x + 80y + 50z \leq 1000$

ERASE

14

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

A timber company has forest land with trees suitable for furniture, plywood, and pulpwood. It requires 100 hours of labor and 20 hours of machine time to harvest 1 unit of timber for furniture; and it requires 80 hours of labor and 30 hours of machine time to harvest 1 unit of timber for plywood; and it requires 50 hours of labor and 30 hours of machine time to harvest 1 unit of timber for pulpwood. Net profit is $500 per unit for furniture timber, $400 per unit for plywood timber, and $200 per unit for pulpwood timber. The company has 1000 hours of labor, 500 hours of machine time, and ample supplies of all three types of tim ber. How much of each type of timber should be harvested to yield maximum profit?

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

$100x + 80y + 50z \leq 1000$

$20x + 30y + 30z \leq 500$

ERASE

15

LINEAR PROGRAMMING IN HIGHER DIMENSIONS:

EXAMPLE (problem 29, p. 314):

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x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

$100x + 80y + 50z \leq 1000$

$20x + 30y + 30z \leq 500$

ERASE

16

Maximize: $500x + 400y + 200z$

Subject to:

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

x = # units of furniture timber
y = # units of plywood timber
z = # units of pulpwood timber

	Labor	Machine Time
Furniture	100	20 hrs.
Plywood	80	30 hrs.
Pulpwood	50	30 hrs.

Maximize: $500x + 400y + 200z$

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$

17

Maximize: $500x + 400y + 200z$

Subject to:

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

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Lecture 28

Maximize: $500x + 400y + 200z$

Subject to:

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

Graph

$$100x + 80y + 50z = 1000$$

This is a plane.

19

Maximize: $500x + 400y + 200z$

Subject to:

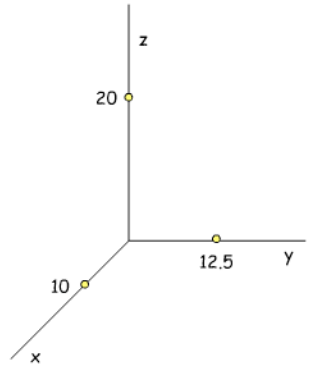
$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

Graph

$$100x + 80y + 50z = 1000$$

This is a plane.

(0,0,20) (10,0,0) (0,12.5,0)



20

Maximize: $500x + 400y + 200z$

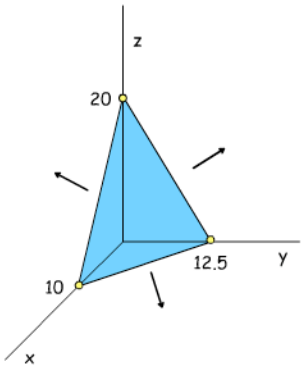
Subject to:

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

Graph

$$100x + 80y + 50z = 1000$$

This is a plane.



21

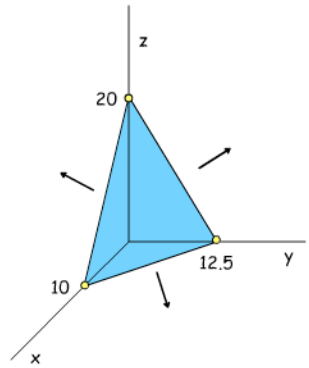
Maximize: $500x + 400y + 200z$

Subject to:

$$100x + 80y + 50z \le 1000$$
$$20x + 30y + 30z \le 500$$
$$x \ge 0$$
$$y \ge 0$$
$$z \ge 0$$

Graph

$$100x + 80y + 50z = 1000$$



Continue. Find the corner points (the intersection of 3 planes). Evaluate the objective function at each of these points. Select the max.

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Obviously this is difficult. There are better ways than graphing methods:

1) Simplex Method (in the book)
2) Khachian algorithm
3) Karmarkar algorithm

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