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**SYSE 5150**

**HW1**

**1.3, 1.4, and propose an optimization problem**

1.3 Determine the optimal solution of the garden problem. (Hint: Use the constraint to  
express the objective function in terms of one variable, then use differential calculus.)

L = 100ft

VARIABLES

w = width of the rectangle in feet

h = height of the rectangle in feet

CONSTRAINTS

w ≥ 0

h ≥ 0

2(w + h) = L

OBJECTIVE

Maximize the area, z = wh

L/2 = w + h

L/2 – h = w

z = wh = (L/2 – h)h = Lh/2 – h2

z’ = 100/2 – 2h = 50 – 2h

2h = 50

h = 25

back substitution into constraint equation L = 2(w + 25)

100 = 2w + 50

50 = 2w

w = 25

**w = 25**

**h = 25**

1.4 Amy, Jim, John, and Kelly are standing on the east bank of a river and wish to cross  
to the west side using a canoe. The canoe can hold at most two people at a time. Amy,  
being the most athletic, can row across the river in 1 minute. Jim, John, and Kelly would  
take 3, 6, and 9 minutes, respectively. If two people are in the canoe, the slower person  
dictates the crossing time. The objective is for all four people to be on the other side of  
the river in the shortest time possible.

(a) Define the criterion for evaluating the alternatives (remember, the canoe is the only  
 mode of transportation, and it cannot be shuttled empty).

The criterion for evaluating the alternatives is successfully accomplishing the goal of transporting all four people to the other side of the river and the amount of time necessary to achieve this result. Minimizing the time to transport everyone is the objective so, the least amount of time is the best alternative.

\*(b) What is the shortest time for moving all four people to the other side of the river?

x1 = 1 minutes

x2 = 3 minutes

x3 = 6 minutes

x4 = 9 minutes

x3, x4 = 9 minutes

x1, x2 = 3 minutes

x1, x4 = 9 minutes

x2, x3 = 6 minutes

So,

← x1, x2 = 3

→ x1 = 1

← x3, x4 = 9

→ x2 = 3

← x1, x2 = 3

**19 minutes**

Or

← x1, x2 = 3

→ x2 = 3

← x3, x4 = 9

→ x1 = 1

← x1, x2 = 3

**19 minutes**

Optimization Problem Proposal

A lithium-ion electric car battery degrades from both dishcarge rate and depth of discharge. The life of a battery is measured by the number of charge and discharge cycles that occur before the capacity drops to 80%. This can be expressed by the formula Life(cycles) = (Capacity(Ah) \* 100) / (Discharge rate(A) \* Depth of discharge(%))

If a 100Ah battery can only be charged a maximum of once per day to 100% capacity and the discharge rate is 20A, what is the optimum depth of discharge that maximizes the number of cycles before the capacity drops to 80%.