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Group 1: Tuesday Tutorial

1. LINEAR PROGRAMMING

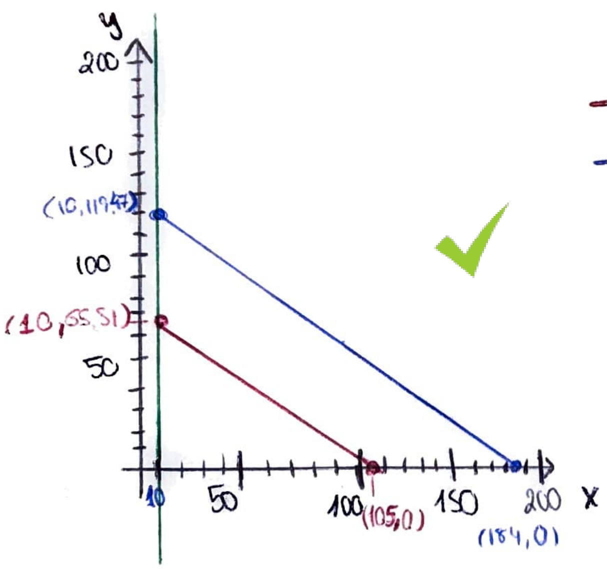
1. max. $20x - 30y - 10\,t_m - 2t_c$, where t_m = machine time
t_c = craftman time

s.t. $13x + 19y \leq \underbrace{2400}$
↳ ~~40×60~~ 40 hours × 60 min.

$20x + 29y \leq \underbrace{2100}$
↳ 35 hours × 60 min.

$x \geq 10$: the company has to produce at least 10 items of x.

2.



1.1

When $x = 10$, $13 \cdot 10 + 19y = 2400$
$19y = 2400 - 130 \rightarrow y = \frac{2270}{19} = 119.47$ (10, 119.47)

$20 \cdot 10 + 29y = 2100$
$29y = 1900 \rightarrow y = \frac{1900}{29} = 65.51$ (10, 65.51)

When $y = 0$, $13x + \cancel{19y}^{0} = 2400$ (184.61, 0)
$x = \frac{2400}{13} = 184.61$

$20x + \cancel{29y}^{0} = 2100$
$x = \frac{2100}{20} = 105$ (105, 0)

2. OPTIMIZATION PROBLEMS

1. $f_1(x) = x$

$$\frac{\partial f_1(x)}{\partial x} = \cancel{\partial} = 1 \overset{!}{=} 0$$

$1 \neq 0$

~~There is not minimum for in $f_1(x)$.~~

~~x can go~~ $f_1(x)$ can go from a to b, and $f_1(x) = x$, ~~Assuming~~ So $\underline{a}$ is the minimum value ~~because~~ ~~a =~~ $x^* = a$, $p^* = a$.

2. $f_2(x) = c\cos(x)$

$f_2'(x) = -c\sin(x)$

$-c\sin(x) = 0$

$x = 0$

$f''_2(x) = -c\cos(x)$

$f''_2(0) = -c > 0$

2.1

p* = -c, that happens at x*=pi or 3*pi

There is a minimum in $-c$

$\underline{x^* = -c}$ x^* is not unique, ~~depends on the co~~

$\underline{p^* = f_2(x^*) = c\cos(-c)}$

3. $f_3(x) = \sin(x)$

$f_3'(x) = \cos(x) = 0$

$x_1 = \arccos(0) = \frac{\pi}{2}$

$x_2 = 2\pi - \frac{\pi}{2} = \frac{3\pi}{2}$

$f''_3(x) = -\sin(x)$

$f''_3(\frac{\pi}{2}) = -1 < 0$ not a minimum

$f''_3(\frac{3\pi}{2}) = 1 > 0$ $\underline{x^* = \frac{3\pi}{2}}$ and it is unique

$p^* = f_3(x^*) = \sin(\frac{3\pi}{2}) = \underline{-1}$

4. $f_4(x) = \frac{\sin(x)}{x^2} = \sin(x)\cdot x^{-2}$

$f'_4(x) = \sin(x)(-2)\cdot x^{-3} + \cos(x)\cdot x^{-2} = \frac{-2\sin(x)}{x^3} + \frac{\cos(x)}{x^2} = 0$

$\frac{-2\sin(x) + x\cos(x)}{x^3} = 0 \rightarrow -2\sin(x) + x\cos(x) = 0$

$x\cos(x) = 2\sin(x)$

$x = 2\tan(x)$

$x = 4.2748$

$f''_4(x) = -2\sin(x)\cdot(-3)x^{-4} + (-2)\cos(x)\cdot x^{-3} + \cos(x)(-2)x^{-3} + x^{-2}(-\sin(x)) =$

$= \frac{6\sin(x)}{x^4} + \frac{-2\cos(x)}{x^3} - \frac{2\cos(x)}{x^3} - \frac{\sin(x)}{x^2} = \frac{6\sin(x) - 2x\cos(x) - 2x\cos(x) - x^2\sin(x)}{x^4} =$

$= \frac{6\sin(x) - 4x\cos(x) - x^2\sin(x)}{x^4}$

3.1

~~$f''_4(3.4)$~~

$f''_4(4.2748) = -3.97 < 0$ >0

misscalculated

There is not minimum.

5. $f_5(x) = x^3 - 3x$

$f'_5(x) = 3x^2 - 3 = 0$

$3x^2 = 3$

$x^2 = 1 \rightarrow x = \pm 1$

$f''_5(x) = 6x$

$f''_5(1) = 6 > 0$ ← it's a minimum

$f''_5(-1) = -6 < 0$

$x^* = 1$ it is unique

$p^* = f(x^*) = 1^3 - 3\cdot 1 = -2$

Index der Kommentare

1.1 Here you should mention at which point the maximum profit occurs

2.1 it should be p*=-c which happens at x*=pi or 3*pi and so on ..

3.1 the formula for 2nd dervative is correct but the value of f''(4.27) is miscalculated