Lezione 4 - 11/10/2019

Weak order
PI = { Reflexive, complete, transitive} = WEAK ORDER
Define Value function any function v witch associated a F [?] |R
Utility function in economy
Value function v : F —> |R is consistent with a preference relation PI when quite easy to define
f <= f' —> v(f) >= v(f')

Th. If PI has a consistent value function v then PI is a weak order. Why true? I'm assuming that my preference relation has a value function consistent. Now I need to proof the my preference relation is Reflexive, complete and transitive.

We know that PI has a consistent value function and transitivity f <= f' and f'>= f" —> f <= f" and then we add this part (are we able o prove this?).
F <= f' and f' <= (is better) f"
V(f) >= v(f') and v(f') >= v(f") —> v(f) >= v(f"), so f <= f" so f is preferable.

What we want is a value function from a weak order.
F >= |R^2 f = [f1 f2] ^ T
PI = { (f, f') appartiene FxF : (f1 < f1') OR [(f1= f1') AND (f2 <= f'2)] }
[DISEGNO

Suppose that the cost f1 is not a real number (and actually it isn't) what happen is that time can be thought as real. We have these solution that is better that any solution that cost more in time but the cost is not continuous. The solution are these lines here and the point is better than the other lines. Can you write an objective function with a single number? Each of these are infinite but have different infinity point and then we can have a cost function
C (f) = f1 [how much I'm paying] + 0.01 /2 Th [hyperbolic function] (f2)
Take time and transform time to any number and actually we turning interval with infinite values.
Some weak order cannot be reorder is a utility function

Mathematical programming

We are trying to solve the problem, not only describe it. We have to define which problem are going to resolve.
Suppose that
(X, OMEGA, F, f, D , PI)
F <= |R we have one indicator
The problem is determinist and the number of decision maker is 1. Preference relation is weak order with a consistent value function. Physical region is not only a subset, is the set of all real vector such that certain function ..
|Omega | = 1
|D | = 1
PI is a weak order [?] in reality is cost function so I prefer smaller value.
X = { x appr |R^n : gj (X) <= 0 for j = 1,…m} with gj appr C^1 (x).
I need the first derivative to be continuous and make another assumption. (f)^-v so I call it directly f the function that I want to minimize. Min [-v (f (x,w))], I can simply: omega is fixed (not exist) and v(f(x)) is just a composite function and I can write c(x) it's the same. And I call this

function f to simply more.
I’m assuming that f appr C^1 (x) because I make to do derivatives.

Example.
City in 0, 1 is dump and I want the new dump at least dist 2 from the origin. So I put it outside of a circle. I exclude the part inside and are unfeasible. How can I write in analytical term this? A point outside the circle (x1, x2)
Rad[(x1 – 0) ^2 + (x2- 0) ^2] >= 2
I put -4 and put minus <= 0
-(x1 -0)^2 – (X2-0)^2 +4 <= 0 —> so any function can be written in this way
X1+x2 = 5 |X1+x2 <= 5   <=0
|X1+x2 >= 5   >=0

The only limit is that the function is the first derivative of gj
There’s a park there in 3/2 and we can’t put the nuclear waste in the right of that line. We just want to be x1 <= 3/2 —> x1 – 3/2 >= 0
THIS IS REQUIRED AT THE EXAM
What about the objective function? We want to minimizing the distant.
We write like min f(x) = (X1-1)^2 + x2^2
Derivative = 0 to get the minimum

Global optimum point —> point x^0 appartiene X : f(x)^0 <= f(x) per ogni x app X
We can try to find local optimum point
Local optimum point
It’s a point X* appar X : f(x*) <= f(x) per ogni x app X AND U[neightbourg] (x*,eps)]
U(x*, eps) è un sotto insieme
Punto di ottimo globale è anche punto di ottimo locale.

KKT —> Karush-Kuhn-Tucker Conditions