Stepwise calculation for case 1:

Input 1:

INPUT 1a				INPUT 1b		
Sex	Weight	Height	Age	Phy. Act.	Temparature	Altitude
Male	70kg	173cm	25	90mint/day	27°c	98m

Table 6: *INPUT 1: Case 1 patient data for calculation of required calorie*

Section 3.1.1 (Basic Calorie)

Sex	Basal Metabolic Rate (BMR)
Male	66+(13.7×Weight)+(5×Height)-(6.8×Age)
Female	655+(9.6×Weight)+(1.8×Height)-(4.7×Age)

Table 1: *Harris-Benedict Equations*

With the help of **Table 1** and **Input 1a** calculate **Basic Calorie**

Basic Calorie = 66+(13.7*70)+(5*173)-(6.8*25)

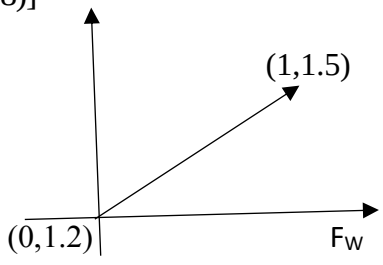
=1720

Section 3.1.2 (Extra Calorie)

1) Physical Activity (weight taking 0.8) $f_1(x) = \frac{1}{1+e^{-0.05(x-80)}}, x \approx [1,150]$
2) Temperature (weight taking 0.1) $f_2(x) = \frac{1}{1+e^{0.2(x-22)}}, x \approx [1,50]$
3) Altitude (weight taking 0.1) $f_3(x) = \frac{1}{1+e^{0.0015(x-3000)}}, x \approx [-2.2,8611]$

So, $F_W(f_1, f_2, f_3) = [0.8, 0.1, 0.1].[f_1(90), f_2(27), f_3(98)]$

$=0.5261$



For scaling between 1.2 to 1.5 taken

$y = 0.3 * F_W + 1.2$

$= 0.3 * 0.5261 + 1.2$

$= 1.3578$

Total daily required Calorie=

Basic Calorie*Extra Calorie=

1720*1.3578=

2335.5

For a diabetic patient, we take daily need carb=55%, prot= 23%, Fat= 27%, Fiber= 26gm/1800cal

So, 1st calculate daily required nutrients in calorie:

Carb	Total daily required Calorie*55%	2335.5*55%	1284.5
Prot	Total daily required Calorie*23%	2335.5*23%	525.5
Fat	Total daily required Calorie*27%	2335.5*27%	642.3
Fiber	Total daily required Calorie*(26/1800) gm	2335.5*(26/1800) gm	33.73

Since, 1gm Carb=4 cal, 1gm Prot=4 cal, 1gm Fat=9 cal

So, daily required nutrients in gram:

Nutrients	daily required nutrients in calorie:		daily required nutrients in gram:
Carb	1284.5	1284.5/4	321.13
Prot.	525.5	525.5/4	131.37
Fat	642.3	642.3/9	71.36
Fiber	33.7	33.73	33.73

INPUT 2:

INPUT 2: Case 1 patient February, 14, 2018

Item	Quantity	Amount	Carb	Prot	Fat	Fiber
Breakfast						
Tea	1cup	250ml	11.5	4.2	4.4	0
Ankurit Chana	1/2 katori	50gm	6.7	2.1	0.7	1.9
Mung	1/4 cup	51gm	28.9	12.2	0.7	8.5
Puri	3pcs	75gm	32.7	6.0	8.0	4.9
Lunch						
Tawa Roti	4pcs	140gm	69.4	12.1	1.7	10.7
Rice	1katorie	100gm	25.6	2.5	0.3	0.4
Cabbage Subzi	1katorie	100gm	4.7	1.9	4.2	2.8
Boondi Raita	1katorie	150gm	8.1	3.9	7.9	0.8
Evening Snack						
Boiled Egg	2pcs	100gm	1.9	12.3	12.3	0
Banana Shake	1glass	250ml	29.3	6.5	5.5	1.3

Table 7: *INPUT 2: Case 1 patient intake food list upto before Dinner and corresponding nutrients*

So, Intake Nutrients in gram for this day (Sum of respective column)	218.80	63.7	45.7	31.3

So, need nutrients for Dinner on that day in grams:

Nutrients	daily required nutrients in gram- Intake Nutrients in gram	need nutrients for Dinner in gram
Carb	321.13-218.80	102.33
Prot.	131.37-63.7	67.67
Fat	71.36-45.7	25.66
Fiber	33.73-31.3	2.43

So, needed nutrients for dinner in [0,1] scale: Carb= 102.33/321.13=0.3187

Prot=67.67/131.37=0.5151

Fat=25.66/71.36=0.3596

Fiber=2.43/33.73=0.0722

So, our knowledge set (X) will be [0.3187, 0.5151, 0.3596, 0.0722]

Calculation for Utility Matrix(U):

INPUT 3:

Item	Carbohydrates	Protein	Fat	Fiber	
Roti	17.4	3.0	0.4	2.7	U_1
Rice	25.6	2.5	0.3	0.4	U_2
Mixed Veg	5.3	1.8	3.0	2.1	U_3
Soyabean Badi Sabji	7.1	4.9	4.0	2.8	U_4
Chicken Curry	5.6	19.2	3.8	2.4	U_5
Arhar Dal	21.6	7.4	2.0	3.8	U_6
Green Salad	3.2	1.4	2.1	1.5	U_7
Hot Milk	11	8	10.2	0	U_8

Table 8: *INPUT 3: Case 1 patient Dinner Choice and respective utility matrix(U)*

Utility Matrix(U)

μ_x

X
0.3187
0.5151
0.3596
0.0722

Fuzzy Utility Associated

	$\tilde{U}_1$	$\tilde{U}_2$	$\tilde{U}_3$	$\tilde{U}_4$	$\tilde{U}_5$	$\tilde{U}_6$	$\tilde{U}_7$	$\tilde{U}_8$
Carb.	$0.32_{17.4}$	$0.32_{25.6}$	$0.32_{5.3}$	$0.32_{7.1}$	$0.32_{5.6}$	$0.32_{21.6}$	$0.32_{3.2}$	$0.32_{11.0}$
Prot.	$0.52_{3.0}$	$0.52_{2.5}$	$0.52_{1.8}$	$0.52_{4.9}$	$0.52_{19.2}$	$0.52_{7.4}$	$0.52_{1.4}$	$0.52_{8.0}$
Fat	$0.36_{0.4}$	$0.36_{0.3}$	$0.36_{3.0}$	$0.36_{4.0}$	$0.36_{3.8}$	$0.36_{2.0}$	$0.36_{2.1}$	$0.36_{10.2}$
Fiber	$0.07_{2.7}$	$0.07_{0.4}$	$0.07_{2.1}$	$0.07_{2.8}$	$0.07_{2.4}$	$0.07_{3.8}$	$0.07_{1.5}$	$0.07_{0.0}$

Maximizing Fuzzy Set

	U_1^{Max}	U_2^{Max}	U_3^{Max}	U_4^{Max}	U_5^{Max}	U_6^{Max}	U_7^{Max}	U_8^{Max}
Carb.	$1.0_{17.4}$	$1.0_{25.6}$	$1.0_{5.3}$	$1.0_{7.1}$	$0.29_{5.6}$	$1.0_{21.6}$	$1.0_{3.2}$	$1.0_{11.0}$
Prot.	$0.17_{3.0}$	$0.10_{2.5}$	$0.34_{1.8}$	$0.69_{4.9}$	$1.0_{19.2}$	$0.34_{7.4}$	$0.44_{1.4}$	$0.73_{8.0}$
Fat	$0.02_{0.4}$	$0.01_{0.3}$	$0.57_{3.0}$	$0.56_{4.0}$	$0.20_{3.8}$	$0.09_{2.0}$	$0.66_{2.1}$	$0.93_{10.2}$
Fiber	$0.16_{2.7}$	$0.02_{0.4}$	$0.40_{2.1}$	$0.39_{2.8}$	$0.12_{2.4}$	$0.18_{3.8}$	$0.47_{1.5}$	$0.0_{0.0}$

$\frac{U_1(1)}{Max(U_1)}$

$\frac{U_1(2)}{Max(U_1)}$

$\frac{U_8(3)}{Max(U_8)}$

Minimum of 0.07 and 0.16

Minimum of 0.52 and 1.0

Fuzzy Optimal Utility

	$U_1^{optimal}$	$U_2^{optimal}$	$U_3^{optimal}$	$U_4^{optimal}$	$U_5^{optimal}$	$U_6^{optimal}$	$U_7^{optimal}$	$U_8^{optimal}$
Carb.	$0.32_{17.4}$	$0.32_{25.6}$	$0.32_{5.3}$	$0.32_{7.1}$	$0.29_{5.6}$	$0.32_{21.6}$	$0.32_{3.2}$	$0.32_{11.0}$
Prot.	$0.17_{3.0}$	$0.10_{2.5}$	$0.34_{1.8}$	$0.52_{4.9}$	$0.52_{19.2}$	$0.34_{7.4}$	$0.44_{1.4}$	$0.52_{8.0}$
Fat	$0.02_{0.4}$	$0.01_{0.3}$	$0.36_{3.0}$	$0.36_{4.0}$	$0.20_{3.8}$	$0.09_{2.0}$	$0.36_{2.1}$	$0.36_{10.2}$
Fiber	$0.07_{2.7}$	$0.02_{0.4}$	$0.07_{2.1}$	$0.07_{2.8}$	$0.07_{2.4}$	$0.07_{3.8}$	$0.07_{1.5}$	$0.00_{0.0}$
$\sum$	0.58_{Roti}	0.45_{Rice}	$1.09_{M.Veg}$	$1.27_{Soya.B.S}$	$1.08_{Chicken.C.}$	$0.82_{A.Dal}$	$1.19_{G.Salad}$	$1.20_{H.Milk}$

Column wise sum

If elements of sum result are >1, then normalize the sum elements to obtain $A^{optimal}$.

Fuzzy Optimal Alternative

$A^{optimal}$	0.45_{Roti}	0.35_{Rice}	$0.86_{M.Veg}$	$1.00_{Soya.B.S}$	$0.85_{Chicken.C.}$	$0.65_{A.Dal}$	$0.93_{G.Salad}$	$0.94_{H.Milk}$

$\frac{U_1^{optimal}(1)}{Max(\Sigma)} = \frac{0.58}{1.27} = 0.45$

$\frac{U_1^{optimal}(5)}{Max(\Sigma)} = \frac{0.58}{1.27} = 0.45$