

**Computational Intelligence**  
**Assessment 1**  
**Part B – Disposition Estimator**

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In this part of the assessment we created a fuzzy logic system which measures a person's deposition based on their age, health and income.

First, we need to create a set of linguistic variables which respectively represent the input and output variables. Each variable needs a domain range of values.

For the age variable we have chosen a range of 20 – 60 to represent ages from 20 to 60 years old. This variable has been split up into 3 terms which are young, middle and old. This is shown in Figure 1.

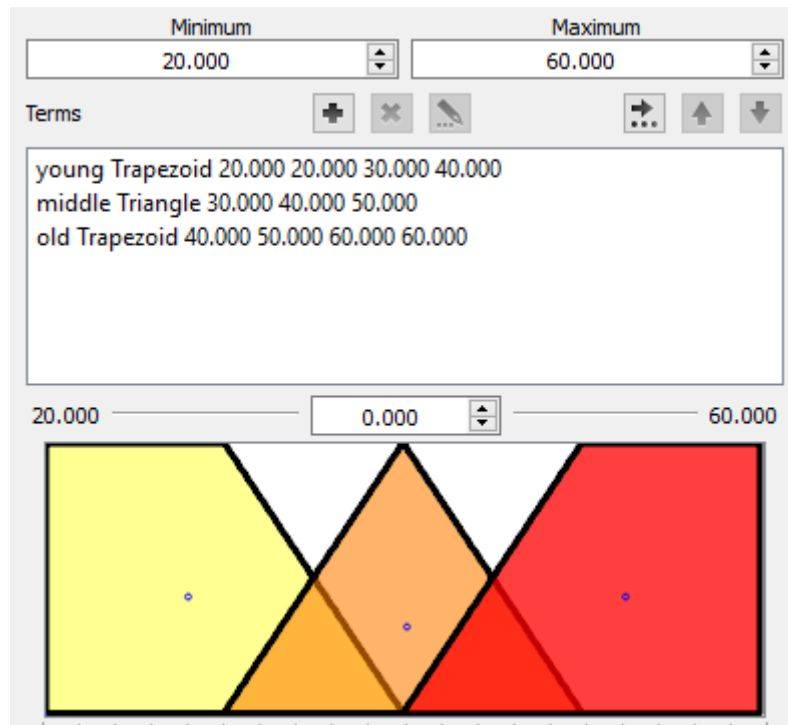


Figure 1: Age input variable

For the health variable we have chosen a range of 0 – 10 to rate the person's health from 1 to 10. This variable has been split up into 3 terms which are bad, good and great. This is shown in Figure 2.

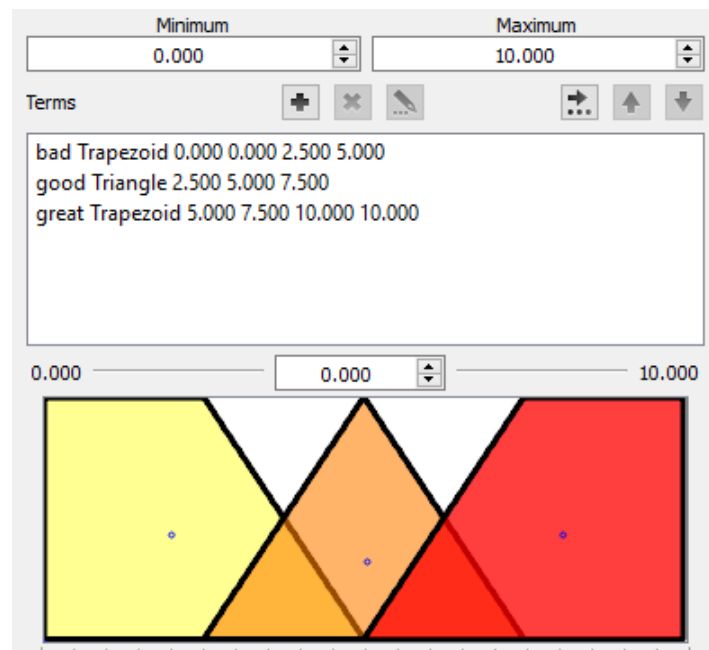


Figure 2: Health input variable

For the income variable we have chosen a range of 0 – 60 to show the person's salary from 0 to 60'000 euro. This variable has been split up into 3 terms which are lower, middle and upper. This is shown in Figure 3.

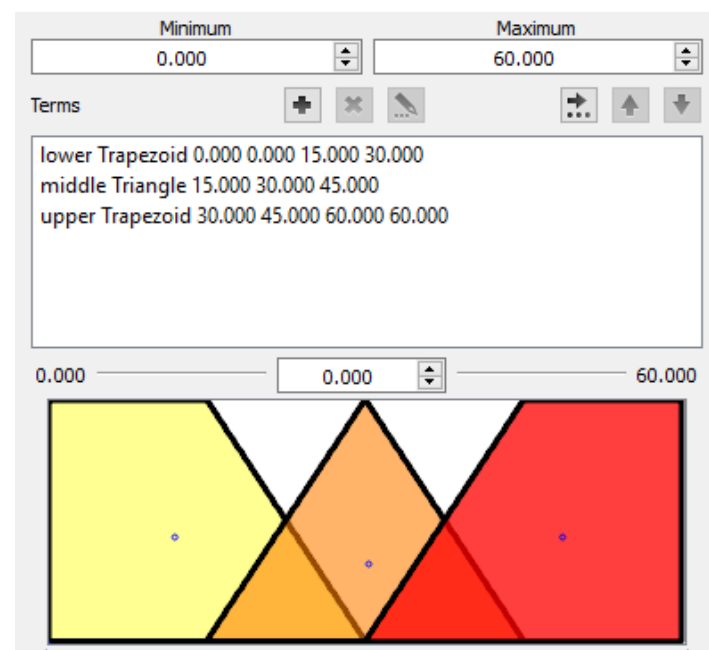


Figure 3: Income input variable

For the output we have selected a range of 0 – 1. The terms range from miserable to ecstatic. The accumulation function which we have selected is MAXIMUM and the defuzzifier function we have selected is CENTROID.

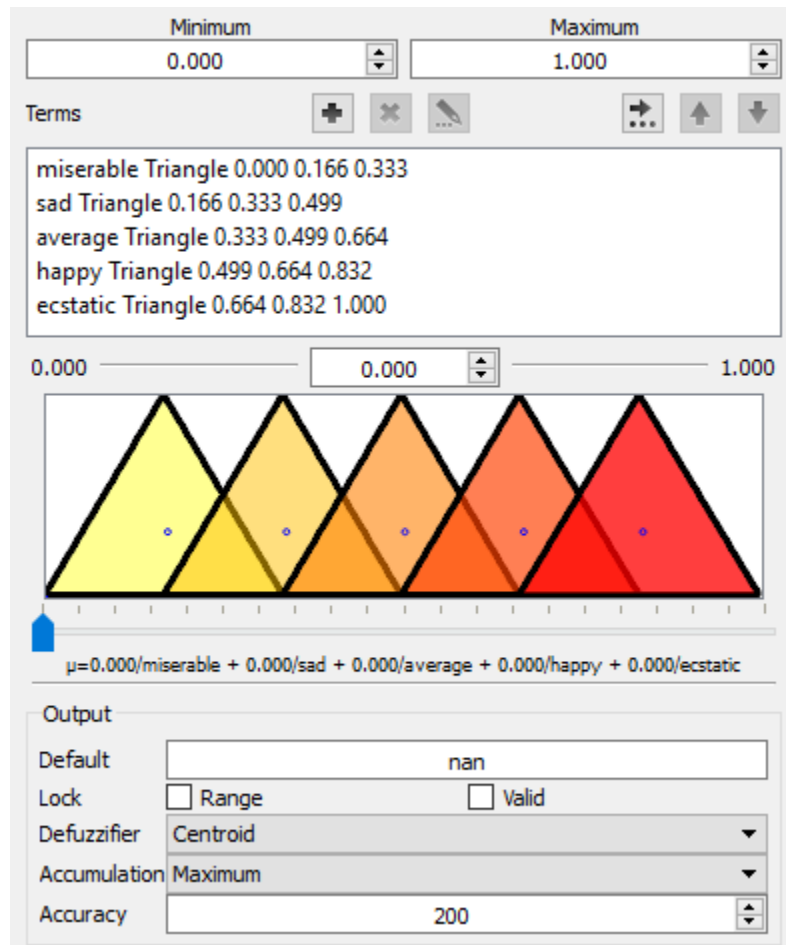


Figure 4: Happiness output variable

Terms are used to split up variables into more understandable sections. They help to describe the variable. The set of terms used in this fuzzy logic system are outlined in table 1.

Term	Description
Y	Young
M	Middle
O	Old
B	Bad
G	Good
GR	Great
L	Lower
U	Upper
MI	Miserable
S	Sad
A	Average
H	Happy
E	Ecstatic

Table 1: Terms

After the terms have been set we have to create a set of rules that will take the inputs and produce a suitable output. We use a decision matrix to out the possible values. The centre of the grid will show the desired values for the output value happiness.

		Age			Health			Income		
		Young	Middle	Old	Bad	Good	Great	Lower	Middle	Upper
Age	Young	/	/	/	S	A	H	A	H	E
	Middle	/	/	/	S	A	H	S	A	E
	Old	/	/	/	S	H	E	S	H	E
Health	Bad	S	S	S	/	/	/	M	S	A
	Good	A	A	H	/	/	/	S	A	H
	Great	H	H	E	/	/	/	A	H	E
Income	Lower	A	S	S	M	S	A	/	/	/
	Middle	H	A	H	S	A	H	/	/	/
	Upper	E	E	E	A	H	E	/	/	/

Table 2: Decision Matrix

Once the decision matrix is plotted out we can use it to write a set of rules. In the decision matrix outlined in table 2 there is 54 possible outcomes but in this system we will only use 27. This is mainly because we have combined some of them using the && operator.

1. if age is young and health is bad and income is lower then happiness is sad
2. if age is young and health is bad and income is middle then happiness is average
3. if age is young and health is bad and income is upper then happiness is average
4. if age is young and health is good and income is lower then happiness is average
5. if age is young and health is good and income is middle then happiness is happy
6. if age is young and health is good and income is upper then happiness is happy
7. if age is young and health is great and income is lower then happiness is average
8. if age is young and health is great and income is middle then happiness is happy
9. if age is young and health is great and income is upper then happiness is ecstatic
10. if age is middle and health is bad and income is lower then happiness is sad
11. if age is middle and health is bad and income is middle then happiness is average
12. if age is middle and health is bad and income is upper then happiness is average
13. if age is middle and health is good and income is lower then happiness is average
14. if age is middle and health is good and income is middle then happiness is happy
15. if age is middle and health is good and income is upper then happiness is ecstatic
16. if age is middle and health is great and income is lower then happiness is average
17. if age is middle and health is great and income is middle then happiness is happy
18. if age is middle and health is great and income is upper then happiness is ecstatic
19. if age is old and health is bad and income is lower then happiness is miserable
20. if age is old and health is bad and income is middle then happiness is sad
21. if age is old and health is bad and income is upper then happiness is sad
22. if age is old and health is good and income is lower then happiness is sad
23. if age is old and health is good and income is middle then happiness is average
24. if age is old and health is good and income is upper then happiness is happy
25. if age is old and health is great and income is lower then happiness is average
26. if age is old and health is great and income is middle then happiness is happy
27. if age is old and health is great and income is upper then happiness is ecstatic

Now we will need to use defuzzication to produce a useful outcome from the fuzzy data. Since the rules we are using contain connective statements such as AND we have to define how they are handled. In this program we use the MAX and MIN interpretation.

Once everything is inputted into qtFuzzyLite we can test the program. Here are some examples:

If you have a person who is young, their health is great and the income is upper they will be ecstatic.

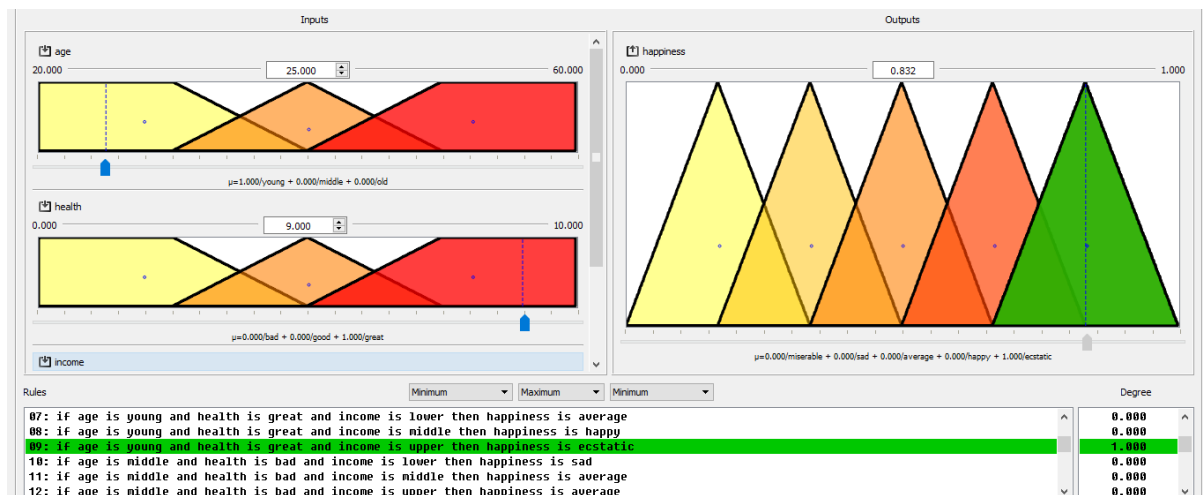


Figure 5: qtFuzzyLite example 1

If you have a person who is old, their health is bad and the income is lower they will be miserable.

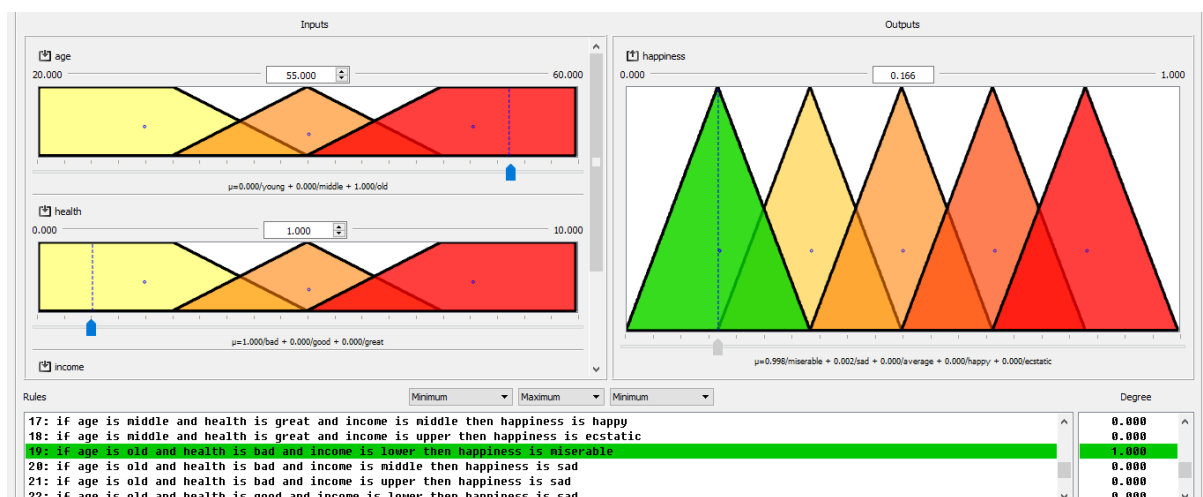


Figure 6: qtFuzzyLite example 2