**Faculty of Technology – Coursework Specification 2020/21**

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| **Module name:** | | Fuzzy Logic | | | | | |
| **Module code:** | | IMAT5119 | | | | | |
| **Title of the Assignment:** | | Assignment 1 – Practical | | | | | |
| **This coursework item is:** (delete as appropriate) | | | | Summative | |  | |
| **This summative coursework will be marked anonymously** | | | | |  | | No |
| **The learning outcomes that are assessed by this coursework are:**   1. Select a problem that suits a fuzzy logic solution and implement a fuzzy logic system as a solution; 2. Critically evaluate fuzzy logic approaches to solve computational problems exhibiting uncertainty and imprecision | | | | | | | |
| This coursework is: (delete as appropriate) | | | Individual | | |  | |
| If other or mixed ... explain here: | | | | | | | |
| **This coursework constitutes** 40 % **of the overall module mark.** | | | | | | | |
| **Date Set:** | 30th September 2020 | | | | | | |
| **Date & Time Due:** | 15th January 2021 at 12 noon | | | | | | |
| **Your marked coursework and feedback will be available to you on:**  If for any reason this is not forthcoming by the due date your module leader will let you know why and when it can be expected. The Head of Studies ([headofstudies-tec@dmu.ac.uk](mailto:headofstudies-tec@dmu.ac.uk) ) should be informed of any issues relating to the return of marked coursework and feedback.  Note that you should normally receive feedback on your coursework by **no later than 20 University working days after the formal hand-in date,** provided that you have met the submission deadline. | | | | | 12th February 2021 | | |
| **When completed you are required to submit your coursework via** the corresponding assignment submission the TurnitinUK link in the Blackboard assessments section for this module. | | | | | | | |
| **Late submission of coursework** **policy:** Late submissions will be processed in accordance with current University regulations which state:  *“the time period during which a student may submit a piece of work late without authorisation and have the work capped at 40% [50% at PG level] if passed is* ***14 calendar days****. Work submitted unauthorised more than 14 calendar days after the original submission date will receive a mark of 0%. These regulations apply to a student’s first attempt at coursework. Work submitted late without authorisation which constitutes reassessment of a previously failed piece of coursework will always receive a mark of 0%.”* | | | | | | | |
| **Academic Offences and Bad Academic Practices:**  **These include plagiarism, cheating, collusion, copying work and reuse of your own work, poor referencing or the passing off of somebody else's ideas as your own. If you are in any doubt about what constitutes an academic offence or bad academic practice you must check with your tutor. Further information and details of how DSU can support you, if needed, is available at:**  <http://www.dmu.ac.uk/dmu-students/the-student-gateway/academic-support-office/academic-offences.aspx> and  <http://www.dmu.ac.uk/dmu-students/the-student-gateway/academic-support-office/bad-academic-practice.aspx> | | | | | | | |
| **Tasks to be undertaken:** Your task is to develop a fuzzy system in Matlab. The system is one for giving advice **on a subject or area of expertise of your choice**. | | | | | | | |
| **Deliverables to be submitted for assessment:** The deliverable is **a report** that summarises the problem and justifies your design decisions. | | | | | | | |
| **How the work will be marked:** Marking scheme for Fuzzy Logic (Matlab) Assignment 1 included in the assignment specification. If necessary, a viva will also be held. | | | | | | | |
| **Module leader/tutor name:** | | **Professor Francisco Chiclana** | | | | | |
| **Contact details:** | | [**chiclana@dmu.ac.uk**](mailto:chiclana@dmu.ac.uk) | | | | | |

MSc Intelligent Systems (IS), MSc IS & Robotics

Fuzzy Logic Assignment 1 – Practical

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**This assignment contributes 40% of your final grade.**

Submission is to the assignment submission TurnitinUK link in the assessments section for this module.

**Please note** – If necessary, we will arrange 10-minute vivas (verbal exchanges) with each of you (using Google Hangout or Skype for distance students). During this we may ask about anything to do with either of the two assignments (and therefore the course content). This is to ensure that you understand the work that you have submitted and that it is your own.

**Task**

Your task is to develop a fuzzy system in Matlab (will be supported in the module with a weekly lab) or using a programming language of your choice (not supported in the weekly lab). The system is one for giving advice **on a subject or area of expertise of your choice**.

**For example...**

You could give advice on whether a person should play a particular sport; you could choose the sport and you could ’make up’ a sensible set of fuzzy rules for your system. Possible input variables depending on the sport chosen could be:

• Level of Athleticism

• Hand-Eye Co-ordination

• Interest in team games

• Etc

Or you could advise on whether a person should learn to play a particular musical instrument. Again, you could choose the particular instrument. Input variables for this might include:

• Hand-Eye co-ordination

• Ability to read music

• Interested in solo performance / orchestral / rock band etc.

You should aim to have **3 or 4 input variables**.

**For whatever advice system you decide on.....**

* You need to use appropriate membership functions to represent the linguistic terms associated with each input variable.
* You should compare and contrast the results of using different shapes membership functions, different operators, etc. and evaluate the results by testing your system with a variety of input values. Make sure you test boundaries thoroughly (e.g. where the membership functions overlap etc.)
* You should investigate the different defuzzification techniques available in Matlab and carry out an analysis of their effects in this specific problem.
* You should consider carefully the rules that you include – enough to meet the needs of the system but make sure that you do not have multiple rules doing the same job. This is an issue in fuzzy systems and is well documented in the literature. The second edition of the Timothy Ross book has a Chapter on this (Chapter 9).
* You should consider and explain in your report what the output results for your system actually mean.

**Deliverable**

The deliverable is **a report** that summarises the problem and justifies your design decisions.

* It should provide a commented listing of the Matlab Commands used and appropriate graphical output.
* It should show some fine-tuning of the system to produce sensible results and there should be a discussion of the effects of using different membership functions, operators, defuzzification techniques, etc.
* As a guide you should aim to make the report should be around 8 sides of A4 (using a sensible sized font and line spacing). We are not imposing a penalty for reports that are too long or too short but this is intended to be a technical report and it should present your work in a concise manner, so in-concise reports may well not meet this criterion and therefore may not be classed as well written. Conversely, very short reports might not explain the system fully to the reader.
* Additionally, there should be appropriate use of appendices to provide detailed results.
* The work will be marked from the report and its appendices. If you would like to submit a copy of your fuzzy inference system then email it to us. (If you used an m file to create it please put that on as well. If you are submitting multiple files for the practical part please Zip them before sending by email).

**Marking scheme for Fuzzy Logic (Matlab) Assignment 1 – worth 40% of overall mark**

Name………………………………………….

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|  | ***Criteria*** | **0-44%**  **Fail** | **45-49%**  **Marginal Fail** | **50-59%**  **Pass** | **60-69%**  **Merit** | **>70%**  **Distinction** |
| **LO2** select a problem that suits a fuzzy logic solution and implement a fuzzy logic system as a solution; | C1. Problem description and initial design decisions, MFs etc. | Not acceptable. | Some attempt but with serious limitations. Poor implementation or little/no evidence of the implementation in the report. | Some good ideas but with notable limitations. The system performs to a reasonable level. The results are presented reasonably clearly. | Very good description and good design ideas. Only minor limitations. You have produced a working system that produces good results. | Excellent, showing a sound understanding of topic. You have produced a working system that produces the desired and best results. |
|  | C2. Fine tuning, discussion of other MFs, rule tuning, operators, de-fuzz techniques etc. | Very little of value | Weak, with substantial limitations. Some effort evident. | Some good work, tried some different techniques with some understanding evident. | Very good work. Competent investigation of various techniques for fine tuning. Only minor limitations. | Thorough and complete, well documented, excellent approach. |
| **LO1** critically evaluate fuzzy logic approaches to solve computational problems exhibiting uncertainty and imprecision | C3. System evaluation and conclusions (this could be dispersed throughout the report rather than in a specific section). | Missing or poor or not meaningful | A minimal attempt with serious limitations. Shows little understanding. | Satisfactory - good, but with some notable limitations. Lacks depth. | Very good, comprehensive, with good ideas. | Excellent, follows logically from body of report and contains excellent and original ideas. |
|  | C4. Structure and presentation. Use of reference sources, bibliography. | No clear structure, and presentation very weak. Poor or no references. | Weak structure poor presentation.  Poor use of reference sources. | Satisfactory structure and presentation. Satisfactory use of reference sources. | Very well structured and prepared with only minor limitations, good use of reference sources. | Highly professional approach; excellent structure & good use of reference sources. |

The first 3 marking criteria above form the major part of the assessment. The 4th is an expectation and if the work is lacking in this respect then it will affect the final mark.