Data Provided: None

The University Of Sheffield.

DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2007-2008 (2 hours)

Multi-Sensor Data Fusion EEE 6083

Answer **THREE** questions. **No marks will be awarded for solutions to a fourth question.** Solutions will be considered in the order that they are presented in the answer book. Trial answers will be ignored if they are clearly crossed out. **The numbers given after each section of a question indicate the relative weighting of that section.**

1. a. Describe the algorithm to perform *Single Linkage Clustering.* Describe the operational steps in detail. **(5)**

Table 1 shows the distances between some Italian cities:

	BA	FI	MI	NA	RM	TO
BA	0	662	877	255	412	996
FI	662	0	295	468	268	400
MI	877	295	0	754	564	138
NA	255	468	754	0	219	869
RM	412	268	564	219	0	669
TO	996	400	138	869	669	0

Table 1

b. Describe how the *Single Linkage Clustering* algorithm would be applied to the data in Table 1. **(5)**

c. Derive the *Hierarchical Tree* for these cities, showing your working at each step. **(10)**

2. **a.** Draw a flowchart of the *JDL Data Fusion Process Model*. **(4)**

b. Briefly describe the levels in the JDL process model, emphasising the *Draft Revised Model (1997)* components. **(6)**

c. Describe in flowchart form, the three basic methods of data fusion. **(5)**

d. Briefly describe the following major challenges in multisensor fusion: **(5)**

i: Robust sensors, ii: Image and non-image fusion, iii : Robust target identification.

3. **a.** In terms of *Input / Output Characterisation,* describe the input/output modes of data fusion based on the three fundamental levels of *data-feature-decision.* **(12)**

b. Briefly describe, with the aid of a diagram, the principles of *decentralised fusion.* **(8)**

4. **a.** Show how the functions of the Boolean operators AND, OR and NOT are preserved in fuzzy inference systems by utilising alternative operators. **(5)**

b. Graphically show the differences in output between *two valued* (Boolean) and *multi-valued* (Fuzzy) logic. **(5)**

c. Briefly describe *Sugeno*–type Fuzzy inference. Include details and a diagram on output membership functions. What are the similarities to *Mamdani*-type inference? **(5)**

d. Why would *Sugeno* –type inference be ideally suited to aircraft control? **(5)**

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