MZUZU UNIVERSITY

FACULTY OF SCIENCE, TECHNOLOGY AND INNOVATION

DEPARTMENT OF ICT

BICT4801 ARTIFICIAL INTELLIGENCE Take_Home_Test

TIME ALLOWED: 6 HRS

Instructions:

- Answer **ALL** questions.
- Show your working step-by-step clearly.

1. Propositional Logic, PL, constitutes a vital concept in Artificial Intelligence.

   (a) Convert the following PL sentences to canonical normal form , CNF:

   (i) $A \Leftrightarrow (B \vee E)$ **[6 marks]**

   (ii) $(A \vee B) \wedge (A \Rightarrow C) \wedge (B \Rightarrow D) \wedge (C \Rightarrow G) \wedge (D \Rightarrow G)$ **[4 marks]**

   (b) Prove, using resolution, that the sentence in 1(a)(ii) entails G **[6 marks]**

   (c) A sentence is in disjunctive normal form, DNF, if it is the disjunction of conjunctions of literals. For example $(A \wedge D) \vee (\neg B \wedge C)$ is in DNF.

   (i) Any PL sentence is logically equivalent to the assertion that some possible world in which it would be true is in fact the case. From this observation, prove that any sentence can be written in DNF. **[4 marks]**

   (ii) From your understanding of the CNF algorithm, construct a non-trivial algorithm that converts any PL sentence into DNF. **[5 marks]**

   (iii) Convert the knowledge base, $KB = (A \Rightarrow B) \wedge (B \Rightarrow C) \wedge (C \Rightarrow \neg A)$, into DNF applying the algorithm constructed in 1(c)(ii) **[10 marks]**

2. From your understanding of First Order Logic, FOL, and the vocabulary given in Table 1, write the following paragraph in FOL:

There exists a lecturer all of whose clients are students. Every student is a client of a lecturer. Thondoya has a father who is a lecturer. Thondoya is neither a student nor a lecturer.

[15 marks]

Table 1: Basic Vocabulary	
L	: Lecturer
S	: Student
F	: Father
T	: Thondoya
D(p,d)	: Person p has designation d
C(x,y)	: Person x is a client of person y

END OF QUESTION PAPER