Architecture and Operating System

Coursework 1:

Artificial Intelligence: Design an Expert System Circuit for Healthcare Diagnosis

Introduction

The coursework focuses on your efforts to interpret the problem, think about what is being asked and present a reasoned design. The assignment carries **10%** of the unit marks. Please read the coursework brief carefully.

Group

This coursework is to be carried out in groups (3-4 members from **ONLY** your practical session). Any individual work carried out without a group can only achieve a maximum of pass mark (40%).

Deadline

Coursework Issued: **Thursday 10th October 2019**

You need to submit your files (see below) via the unit's Moodle site by the deadline of **Friday 25th October 2019 16:00,** and will be required to *demonstrate* your design in a simulated environment in the practicals between **4th** and **7th November 2019**. All group members **MUST** be present and participate in the demonstration.

Simulator

Your design should be built and submitted as a **logicly** file. During your demonstration you will be expected to discuss and demonstrate your circuit design.

Moodle Submission

Each student should submit <u>**separately**</u> the (1) shared logicly design (.logicly file), (2) shared truth table and (3) individual contribution table. If you have handwritten the truth tables then submit a scan or photo. *Using the logicly truth table generator will not be accepted.* Use your group's student IDs to name the files. For example: *111111-222222-333333.logicly* and *111111-222222-333333.doc/pdf/png*

The demonstration will require only one copy of design and truth tables to be opened. The assessor will assume all uploads are identical and will randomly select a design from the group to upload from.

Background : Artificial Intelligence - Expert Systems[1]

Expert systems are computer programs that perform sophisticated tasks once thought possible only for human experts. The term "expert system" is generally reserved for systems that achieve expert-level performance, using artificial intelligence programming techniques such as symbolic representation, inference, and heuristic search. Expert systems are often called "knowledge-based" as their strength derives from such domain-specific knowledge rather than more general problem-solving strategies.

Scenario

You have joined a global software company, PortAI, based in Portsmouth. They have been asked to design a simple expert system for healthcare primary diagnosis to support decision making when patients refer to Emergency Department (ED) at the Queen Alexandra Hospital, Portsmouth. When patients arrive at ED, their four vital signs are measured and entered by nurses to the designed expert system and the system outcome will help nurses primary diagnose the patient and undertake the necessary actions.

The four vital signs are:

1- Blood Pressure (BP)
2- Heart Rate (HR)
3- Body Temperature (BT)
4- Respiratory Rate (RR)

And, the four primary diagnosis in the Emergency Department are A, B, C and D.

Requirements Specifications: Expert System Rules

Using expert knowledge, following rules should be considered and implemented to design the expert system:

1- **IF** a patient has High Blood Pressure and High Heart Rate and High Body Temperature and High Respiratory Rate **THEN** he/she should be primary diagnosed on A.

2- **IF** a patient has only High Blood Pressure or High Heart Rate or High Body Temperature **THEN** he/she should be primary diagnosed on B. (*Note: Respiratory Rate should be low*)

3- **IF** a patient has High Blood Pressure and High Heart Rate and Low Body Temperature **THEN** he/she should be primary diagnosed on C. *Hint: Respiratory Rate can be either high or low.*

4- **IF** a patient has High Respiratory Rate and **only** one of the other signs is High **THEN** he/she should be diagnosed on D.

Please Note: In any other situations and combinations of vital signs, the system's output

[1] Benfer, R. A., Brent, E. E., & Furbee, L. (1991). *Quantitative Applications in the Social Sciences: Expert systems*. Newbury Park, CA: SAGE Publications, Inc. doi: 10.4135/9781412984225

will be **nothing.**

Tasks

Task 1: Select a group (3-4 members) to work with.

Task 2: Create a truth table for all the possible input and output combinations and permutations.

Task 3: Design an expert system circuit in **logicly**. This must be a single circuit.

Task 4: Test the circuit and behaviour of the circuit for all input and output combinations and permutations.

Task 5: Submit the following shared files separately to Moodle:

1. *Truth Table (A scan/image/document)*
2. *Logicly file*
3. *Table of individual contribution (see below)*

Task 6: Demonstrate, in your group, your design and rationale, allowing the assessor an opportunity to test your circuit and discuss your selection of gates, the circuit complexity and design issues.

Gates Classification

For assessment and grading purposes gates are classified according to the following levels. See grading criteria below.

Level	Category	Gates
1	Basic	AND, OR, NOT
2	Advanced	XOR, XNOR
3	Universal	NAND, NOR

Grading Criteria

The grading criteria will be applied to your work in discussion with a tutor during your **demonstration**. The table below is to help you understand the grading criteria and provides you with a frame of reference for your effort. Each of the six criteria is assigned a mark from 0 to 10. The '+' represents a **weighting**. If you see '++', for example, this means that criteria is multiplied by a factor of 2 in the overall grade calculations.

Categories	weighting	Criteria	Basic (0-4)	Intermediate (5-7)	Advanced (8-10)
Truth Table	++	**Permutations of all possible inputs and outputs**	Not complete permutations	All input permutations included but not accurate enough	Comprehensive and accurate truth table
Circuit	+	**Gates**	Basic	Basic and Advanced/Universal	Universal only or Universal/Advanced
	++	**Rule 1 Implementation**	Circuit is poorly thought out	Circuit is quite well thought out	Circuit is very well thought out
	++	**Rule 2 Implementation**	Circuit is poorly thought out	Circuit is quite well thought out	Circuit is very well thought out
	+++	**Rule 3 Implementation**	Circuit is poorly thought out	Circuit is quite well thought out	Circuit is very well thought out
	++++	**Rule 4 Implementation**	Circuit is poorly thought out	Circuit is quite well thought out	Circuit is very well thought out
	+++++	**Circuit Integrity**	Circuit only partially works	Circuit covers majority of scenarios	Circuit covers all scenarios
Group	+++	**Problem Interpretation**	Poor overall analysis of the problems and issues involved	Partial overall analysis of the problems and issues involved	Excellent overall analysis of the problems and issues involved
	+++	**Communication**	Basic	Good	Excellent

Individual Contribution Table

A judgement by the assessor will be made during the demonstration based on the following:

- Ability to talk about concepts, submission and process
- Comments from group members on methods of working together.
- Full participation will **not** be granted if any member contributes only to one/some of the tasks

Contribution of each member (your group's student IDs)	No participation (* 0.0)	Minimal level of participation (* 0.25)	Basic level of participation (* 0.5)	Good level of participation (* 0.75)	Thorough, considerate participation in work. (* 1.0)
e.g. 111111			X		
e.g. 222222					X
e.g. 333333				X	