COMP2004
Embedded Programming and the Internet of Things

20 CREDIT MODULE

ASSESSMENT: 100% Coursework **W1: 30% Set Exercises**
W2: 70% Report

MODULE LEADER: Dr. Nicholas Outram

MODULE AIMS

Students learn about embedded microcontrollers, working with different processor architectures via a simulator, and develop embedded software. The use of hardware peripherals, interrupts, multi-tasking and defensive programming techniques will be explored. Students will optimize the execution time, energy consumption and memory size of their programs. The use of embedded programming within IoT applications is considered.

ASSESSED LEARNING OUTCOMES (ALO):

1. Write low-level embedded programs to safely interface/communicate with hardware peripherals.
2. Apply code optimization in order to reduce the execution time of embedded programs.
3. Apply and evaluate the impact of optimization techniques to general computer systems.
4. Explain the role of embedded programming in IoT devices.3. Outline strategies for achieving parallelism, resource allocation and scheduling within an operating system.

Overview

This document contains all the necessary information pertaining to the assessment of *COMP2004 Embedded Programming and the Internet of Things.* The module is assessed via **100% coursework**, across two elements: *30% Set Exercises* and *70% Report*.

The sections that follow will detail the assessment tasks that are to be undertaken. The submission and expected feedback dates are presented in Table 1. All assessments are to be submitted electronically via the respective DLE module pages before the stated deadlines.

	Submission Deadline	Feedback
Set Exercises (30%)	**24th of March at 15.00**	Within 20 working days
Report (70%)		

Table 1: Assessment Deadlines

All assessments will be introduced in class to provide further clarity over what is expected and how you can access support and formative feedback prior to submission. Whilst the assessment information is provided at the start of the module, it is not necessarily expected you will start this immediately – as you will often not have sufficient understanding of the topic. The module leader will provide guidance in this respect.

Assessment 1: Set Exercises (30%)

Speedup a software application

You are provided with a C code of a software application (https://github.com/kelefouras/comp2004/blob/main/my_github/Coursework/comp2004_coursework.cpp).

1. **Reduce the execution time of the '*inefficient_routine()*' on the Nucleo board, by applying the code optimization techniques you have learned so far [28 marks]**. Provide the speedup achieved on both the debug mode and release mode. The higher the performance gain, the higher the grade. The marking criteria are as follows.

marks	**0-6 marks**	**7-17 marks**	**18-28 marks**
marking criteria	The student has provided a routine that does not generate the right output. The speedup value achieved is low.	The student has provided a performance efficient implementation. The k loops have been fully unrolled and the redundant arrays are removed. Scalar replacement is applied. The redundant if conditions are removed. The speedup value is provided.	The student has provided an outstanding implementation. Other optimizations such as register blocking or loop merge are applied.

2. Run the implementation of the previous task on a personal computer and measure the speedup value achieved **[2 marks]**. Provide the speedup achieved on both the debug mode and release mode. Make sure your code runs for a few seconds, otherwise, the execution time will be inaccurate.

Submission Details

You will submit **a .cpp file** containing **a)** your code**, b)** a list of the optimizations applied, in the order they applied (just name them), **c)** the speedup values achieved on both the Nucleo board and the personal computer used. The ***(b)-(c)*** will be written in the beginning of the file **in comments**. **Submissions that do not include the optimizations applied will be marked with zero.**

General Guidance

Extenuating Circumstances

There may be a time during this module where you experience a serious situation which has a significant impact on your ability to complete the assessments. The definition of these can be found in the University Policy on Extenuating Circumstances here:
https://www.plymouth.ac.uk/uploads/production/document/path/15/15317/Extenuating_Circumstances_Policy_and_Procedures.pdf

Plagiarism

All of your work must be of your own words. You must use references for your sources, however you acquire them. Where you wish to use quotations, these must be a very minor part of your overall work.

To copy another person's work is viewed as plagiarism and is not allowed. Any issues of plagiarism and any form of academic dishonesty are treated very seriously. All your work must be your own and other sources must be identified as being theirs, not yours. The copying of another persons' work could result in a penalty being invoked.

Further information on plagiarism policy can be found here:

Plagiarism: https://www.plymouth.ac.uk/student-life/your-studies/essential-information/regulations/plagiarism

Examination Offences: https://www.plymouth.ac.uk/student-life/your-studies/essential-information/exams/exam-rules-and-regulations/examination-offences

Turnitin (http://www.turnitinuk.com/) is an Internet-based 'originality checking tool' which allows documents to be compared with content on the Internet, in journals and in an archive of previously submitted works. It can help to detect unintentional or deliberate plagiarism.

It is a formative tool that makes it easy for students to review their citations and referencing as an aid to learning good academic practice. Turnitin produces an 'originality report' to help guide you. To learn more about Turnitin go to:
https://guides.turnitin.com/01_Manuals_and_Guides/Student/Student_User_Manual

Referencing
The University of Plymouth Library has produced an online support referencing guide which is available here: http://plymouth.libguides.com/referencing.

Another recommended referencing resource is Cite Them Right Online; this is an online resource which provides you with specific guidance about how to reference lots of different types of materials.

The Learn Higher Network has also provided a number of documents to support students with referencing:
References and Bibliographies Booklet:
http://www.learnhigher.ac.uk/writing-for-university/referencing/references-and-bibliographies-booklet/
Checking your assignments' references:
http://www.learnhigher.ac.uk/writing-for-university/academic-writing/checking-your-assigments-references/