

# Assignment Guidance and Front Sheet

This front sheet for assignments is designed to contain the brief, the submission instructions, and the actual student submission for any WMG assignment. As a result the sheet is completed by several people over time, and is therefore split up into sections explaining who completes what information and when. Yellow highlighted text indicates examples or further explanation of what is requested, and the highlight and instructions should be removed as you populate 'your' section.

This sheet is only to be used for components of assessment worth more than 3 CATS (e.g. for a 15 credit module, weighted more than 20%; or for a 10 credit module, weighted more than 30%).

**To be completed by the student(s) prior to final submission:**

Your actual submission should be written at the end of this cover sheet file, or attached with the cover sheet at the front if drafted in a separate file, program or application.

<b>Student ID</b>	<b>1921983</b>
-------------------	----------------

**To be completed (highlighted parts only) by the programme administration after approval and prior to issuing of the assessment; to be consulted by the student(s) so that you know how and when to submit:**

<b>Date set</b>	25/05/2022
<b>Submission date (excluding extensions)</b>	27/06/2022 12 noon (mid-day)
<b>Submission guidance</b>	<b>Submission requirements</b> <ul style="list-style-type: none"><li>• You must submit your report indicating your student ID number in the title of the submission. i.e., <b>1300001_Report.pdf</b>.</li><li>• The report must be in <b>PDF</b> format.</li><li>• The report must be submitted via <b>Tabula</b> and must not be Zipped.</li><li>• You must zip all the codes used for your report without objects and executable files, and then submit the zipped file indicating the student ID number in the title of the submission, i.e., <b>1300001_Code.Zip</b>.</li><li>• You must check if the report and the zipped file have been uploaded successfully.</li><li>• You must include the assessment front sheet in your report.</li></ul> <b>Report Requirements</b> <ul style="list-style-type: none"><li>• The report should be no more than <b>2500 words</b> but there are no minimum words.</li><li>• The source codes in the report are not included in the total word.</li><li>• The report should include a title page in the report.</li><li>• You should specify the total words used for the report.</li><li>• There is no page limit as long as it fits the total number of words for the report.</li></ul>

	<ul style="list-style-type: none"> <li>The report should follow a logical and well-defined structure with headings and subheadings.</li> </ul>
<b>Marks return date (excluding extensions)</b>	Within 20 working days after the submission deadline.
<b>Late submission policy</b>	If work is submitted late, penalties will be applied at the rate of <b>5 marks per University working day</b> after the due date, up to a <b>maximum of 10 working days</b> late. After this period the mark for the work will be reduced to 0 (which is the maximum penalty). "Late" means <b>after the submission deadline time as well as the date</b> – work submitted after the given time even on the same day is counted as 1 day late.
<b>Resubmission policy</b>	If you fail this assignment or module, please be aware that the University allows students to remedy such failure (within certain limits). Decisions to authorise such resubmissions are made by Exam Boards. Normally these will be issued at specific times of the year, depending on your programme of study. More information can be found from your programme office if you are concerned.

To be completed by the module owner/tutor prior to approval and issuing of the assessment; to be consulted by the student(s) so that you understand the assignment brief, its context within the module, and any specific criteria and advice from the tutor:

<b>Module title &amp; code</b>	WM392 Real Time Operating Systems
<b>Module owner</b>	Dr Young Saeng Park
<b>Module tutor</b>	Dr Young Saeng Park
<b>Assessment type</b>	Written individual report
<b>Weighting of mark</b>	60% of the total module mark

<b>Assessment brief</b>
<p>You are required to find two solutions for two parts using FreeRTOS. The first part has a number of missions with different marking scores and the second part is to design and develop an application based on the given constraints. You must submit a report containing the solutions along with the solutions' source code. The report should be well organized so that each solution can be easily recognised. Also, the solutions' code should be executable without any changes. Remind you again that in your report, you should always provide a source code and clear explanation for each task. The source code is not included in the total word count. Also, you should provide all the source codes for the tasks separately.</p> <p><b>PART 1: Real-Time Environment Sensing Module</b></p>

**(60 marks)**

A software developer, Mr. William, and his team are newly developing the Real-Time Environment Sensing Module-392 (RTESM-392) which displays a real-time environment data such as humidity, temperature and pressure. It is because that the predecessor module (RTESM-100) was expensive because various sensors were attached to collect humidity, temperature, and pressure data, and it was cumbersome to attach a new sensor on the module if a customer wants to collect other data. For this reason, his company wants to develop RTESM-392 module which enables to collect various selective environment data from the Real-Time Environment Sensing Server (RTESS) using WIFI connection.

In the development, Mr. William takes charge of the development in displaying real-time data fetched from the RTESS server. However, he has decided to implement an emulator for the RTESM-392 module first because the hardware for the RTESM-392 module is not ready and even it may take a longer time than he expects. The following missions below show the process of gradually developing the emulator. As a software developer in Real-Time applications, you must complete the missions on behalf of Mr. William. Remember that you must provide your solution (source code) for each mission and its explanation. Also, you may include some screenshots or possibly a video to prove that your solution is working.

**[Mission 1]**

**(20 marks)**

The RTESM-392 module displays a digital clock in the HHMMSS format as a default. Every time a minute points to 0 second, a date in the MMDD format is printed for 2 seconds. Mr. William considers three tasks for this development. One task handles a digital clock, the other task handles a date and another task handles displaying a digital clock and a date. The tasks should share data via global variables using a propriate lock mechanism. The display should be a specific position on a screen to make it easier to recognise. If possible, he may consider an LED type display to make it similar to the RTESM-392 display.

**[Mission 2]**

**(20 marks)**

After completing the Mission 1, Mr. William is going to add more tasks to display temperature, humidity, and pressure data. He plans to display temperature, humidity, and barometric pressure data with headings (T for temperature, H for humidity and P for pressure) whenever a minute points to 10, 30, and 50 seconds respectively. Also, the data is displayed for 2 seconds and then a digital clock keeps working. However, there is one concern that fetching data from the RTESS server may take some time from more than 0.2 second to less than 2 seconds because of the Internet speed. So, Mr. William decides that the RTESM-392 will continue to fetch the necessary data from the server and displays the latest data on the screen. However, the RTESS server is also not ready, Mr. William plans to simply generate randomly the data he needs, but is also considering using the API service provided by OpenWeatherMap over the Internet connection in order to make the data more realistic.

**[Mission 3]**

**(20 marks)**

Mr. William realises that the time interval of displaying temperature, humidity, pressure data is long. So, he decides to add an extra function to display the data immediately via pressing buttons. Each time the 'T', 'H' or 'P' keyboard (replaced by buttons in the RTESM-392) is pressed, the temperature, humidity, and barometric data are displayed for 2 seconds and then the digital clock continues to

run. Remember that this function has the highest priority than others. Thus, whenever 'T', 'H', or 'P' keyboard is pressed, it must work immediately.

## **PART 2: Individual Real-Time Application**

**(40 marks)**

In PART 2, you will design and develop your own application using FreeRTOS based on the constraints given below. Then, you must provide the source code you developed and a report for your application. When designing and developing your application, you must consider the following constraints:

- The application should create at least 3 tasks.
- The output should be easily recognisable such as displaying something on a screen.
- Some tasks should share some global data.
- The application should protect the shared global data from a race condition.
- At least one task should be a periodic task.
- At least one task should be event-driven such as for keyboard response.
- If any task requires the input data, it is allowed to emulate the input.

When preparing your report, you must consider the following:

- The general description of your own application is required at the start.
- If necessary, it is allowed to include a diagram to describe your application.
- The source code should be included in the table to distinguish it from others, and the source code is not included in the word count.
- After the source code, its explanation should follow.
- The outcome of your application should be demonstrated such as by screenshots or possible a video separately.
- There is no limit on the number of words only for PART 2 but there is a limit for the overall report (2500 words).

<b>Word count</b>	<p>2500 words + 10% but there are no minimum words.</p> <p>The source codes in the report is not included in the total word count. Word count is defined as the number of words contained within the main body of the text which include titles, headings, summaries, in-text citations, quotations, and footnotes.</p> <p>Items excluded from the word count are acknowledgements, tables of contents, a list of acronyms, meeting notes, a glossary, a list of tables, or figures.</p> <p>Exceeding the work count: For more than 10% up to and including 20% a deduction of 10 percentage points will be applied. For more than 20% up to and including 30% a deduction of 15 percentage points will be applied. More than 30%, The work will be assigned a grade of 0.</p>
<b>Module learning outcomes (numbered)</b>	<ol style="list-style-type: none"><li>1. Describe the mechanisms of operating system to handle processes, threads, scheduling and communication.</li><li>2. Know the structure and organization of the file system and analyse the components for concurrency management.</li><li>3. Analyse the concepts related to deadlocks and mutual exclusion with time and resource limitations.</li></ol>

	4. Use tools and methodologies for supporting time critical computing systems.
<b>Learning outcomes assessed in this assessment (numbered)</b>	LO2, LO3, LO4
<b>Marking guidelines</b>	<p>First class report is expected to be very high-quality work demonstrating excellent knowledge and understanding, analysis, organisation, accuracy, relevance, presentation, and appropriate skills.</p> <p>Second class report is expected to be high quality work demonstrating good knowledge and understanding, analysis, organisation, accuracy, relevance, presentation, and appropriate skills.</p> <p>Report that presents competent work, demonstrating reasonable knowledge and understanding, some analysis, organisation, accuracy, relevance, presentation, and appropriate skills.</p> <p>Work that is below the standard required for the appropriate stage of an Honours degree will be deemed as fail.</p> <p><b>** Detailed marking rubrics can be found in the mark sheet.</b></p>
<b>Academic guidance resources</b>	<p><b>How to seek further help</b></p> <p>Students are strongly advised to ask tutors via Moodle forum</p> <ul style="list-style-type: none"> <li>• <a href="https://warwick.ac.uk/services/library/students/your-library-online/">https://warwick.ac.uk/services/library/students/your-library-online/</a></li> </ul> <p>Numerous online courses provided by the University library to help in academic referencing, writing, avoiding plagiarism and a number of other useful resources.</p> <p><b>Referencing</b></p> <p>Follow the University of Warwick referencing guidelines, found via the links:</p> <ul style="list-style-type: none"> <li>• <a href="https://warwick.ac.uk/services/library/students/referencing/referencing-styles">https://warwick.ac.uk/services/library/students/referencing/referencing-styles</a></li> <li>• <a href="https://warwick.ac.uk/fac/soc/al-archive/leap/writing/referencing/intext/">https://warwick.ac.uk/fac/soc/al-archive/leap/writing/referencing/intext/</a></li> </ul> <p>Should you experience difficulties likely to seriously impact your ability to complete any module work, please see the website section for Mitigating Circumstances and Reasonable Adjustments at:</p> <ul style="list-style-type: none"> <li>• <a href="https://warwick.ac.uk/services/aro/dar/quality/categories/examinations/policies/mitigatingcircumstances/">https://warwick.ac.uk/services/aro/dar/quality/categories/examinations/policies/mitigatingcircumstances/</a></li> </ul>