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|  | | **ECU** |
| XXXXXXXX |
| Unit Code and Title | **CSG1102: Operating Systems** | **SAMPLE PAPER** |
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| Duration | Reading time | 5 minutes |
|  | Working time | 2 hours |
|  | Total time | 2 hours 5 minutes |
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| **Attempt** | All questions. | |
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| **Marks** | Total value 50 marks. | |
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| **Type of Exam** | **Closed Book** exam – textbooks, reference books or notes may not be consulted during the exam.  Calculators are NOT permitted. | |
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| **Special Instructions** | * Please check the unit code at the top of this paper and ensure that you have the correct exam paper. * Students must read the instructions carefully for each section. * Students should allocate time to each section accordingly. * Please clearly number each answer in your answer booklet by identifying the question number (e.g. Q1, Q2). | |

**Students are not permitted to write on the examination or any other paper during reading time.**

**Do not commence the examination until you are told to do so.**

**Question 1.**

Explain the fundamental differences between interactive, batch, real-time, and embedded systems. (5 Marks)

**Question 2.**

In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems. Name two such problems. Can we ensure the same degree of security in a time-share machine as we have in a dedicated machine? Explain your answers. (5 Marks)

**Question 3.**

Explain the fundamental differences between internal fragmentation and external fragmentation. For each of the four memory management systems (single user, fixed, dynamic, and relocatable dynamic), identify which one causes each type of fragmentation. (5 Marks)

**Question 4.**

Compare and contrast internal fragmentation and external fragmentation. Explain the circumstances where one might be preferred over the other. (5 Marks)

**Question 5.**

Describe the purpose of a buffer and give an example from your own experience where its use clearly benefits system response. (5 Marks)

**Question 6.**

Explain the differences between buffering and blocking. (5 Marks)

**Question 7.**

Given three subroutines of 700, 200, and 500 words each, if segmentation is used then the total memory needed is the sum of the three sizes (if all three subroutines are loaded). However, if paging is used then some storage space is lost because subroutines rarely fill the last page completely, and that results in internal fragmentation. Determine the total amount of wasted memory due to internal fragmentation when three subroutines are loaded into the memory using each of the following page sizes:

1. 200 words
2. 500 words
3. 600 words
4. 700 words (10 Marks)

**Question 8.**

Explain and describe the following:

1. Multiprogramming. Why is it used?
2. Internal fragmentation. How does it occur?
3. External fragmentation. How does it occur?
4. Compaction. Why is it needed?
5. Relocation. How often should it be performed? (10 Marks)