

## ASSIGNMENT BRIEF

<b>HTU Course No:</b> 40201341	<b>HTU Course Name:</b> Operating Systems
<b>BTEC Unit No:</b> R/615/1700	<b>BTEC UNIT Name:</b> Operating Systems

**Version: 3**



<b>Student Name/ID Number/Section</b>	
<b>HTU Course Number and Title</b>	40201341 Operating Systems
<b>BTEC Unit Number and Title</b>	R/615/1700 Operating Systems
<b>Academic Year</b>	2023-2024 Fall
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<b>Assignment Title</b>	Assignment 1
<b>Assignment Ref No</b>	1
<b>Issue Date</b>	30/11/2023
<b>Formative Assessment dates</b>	From 04/01/2024 to 11/01/2024
<b>Submission Date</b>	29/01/2024
<b>IV Name &amp; Date</b>	Razan AlQuran 29/11/2023
<b>Submission Format</b>	
<p>The submission of this assignment consists of Three parts:</p> <ul style="list-style-type: none"> <li>• An individual written report that has a solution for tasks that ends with the word (<b>Report</b>).</li> <li>• A full working source code for tasks that require code implementation, these tasks will end with the word (<b>Code</b>).</li> <li>• <b>Discussion</b> with your instructor (and any other witness) about the submitted work.</li> </ul>	
<b>Unit Learning Outcomes</b>	
<p><b>LO1</b> Investigate different Operating Systems, their functions and user interfaces.</p> <p><b>LO2</b> Explore the processes managed by an Operating System.</p> <p><b>LO3</b> Demonstrate the use of DOS, Windows, UNIX and Linux.</p> <p><b>LO4</b> Analyse appropriate techniques and technologies used in distributed and concurrent systems.</p>	
<b>Assignment Brief and Guidance</b>	
<ul style="list-style-type: none"> <li>• You are required to submit a well formatted <b>Word version</b> report that provides a complete answer for all required report tasks.</li> <li>• Full and clear answers for all required tasks, mention the task number and the subtask number before each answer.</li> <li>• Soft-copy submissions are only allowed, you are required to upload your submission files to the university's eLearning platform through (<a href="https://elearning.htu.edu.jo/">https://elearning.htu.edu.jo/</a>) within the submission date and time stated above. <b>NO SUBMISSION by EMAIL and NO LATE SUBMISSIONS WILL BE ACCEPTED.</b></li> <li>• If you commit any kind of plagiarism, HTU policies and regulations will be applied.</li> <li>• The oral discussion will be scheduled by your instructor after the assignment deadline.</li> <li>• The attendance of the oral discussion is mandatory in the date and time determined by your instructor, the exact discussion schedule will be announced after your submission, and you need to be ready to open your camera from the beginning of the discussion.</li> </ul>	

## **Scenario**

you are working as a junior computer science specialist in one of big companies in Jordan. As part of your responsibilities, you have been assigned to clarify the Operating Systems role in computer science by answering the following five tasks.

### **Task 1 (Report):**

Investigate the process of job scheduling by considering a set of processes with the following burst times (in milliseconds) and arrival times (in milliseconds):

Process	Arrival Time	Burst Time	Priority
P1	0	8	3
P2	1	6	1
P3	2	10	2
P4	3	4	4

Assume a time quantum of 4 milliseconds for the Round-Robin scheduling algorithm.

1. **Round Robin (RR):** Implement the Round Robin scheduling algorithm and provide the sequence of execution for the given time quantum.
2. **Priority Scheduling:** Implement Priority Scheduling (preemptive) and provide the sequence of execution. Use the priority values given for each process.
3. **SJF Preemptive:** Implement Shortest Job First (SJF) scheduling algorithm with preemptive mode and provide the sequence of execution.
4. **SJF Non-Preemptive:** Implement Shortest Job First (SJF) scheduling algorithm in non-preemptive mode and provide the sequence of execution.

Answer the following questions for each scheduling algorithm:

- **Turnaround Time:** Calculate the turnaround time for each process.
- **Waiting Time:** Calculate the waiting time for each process.
- **Average Turnaround Time and Waiting Time:** Calculate the average turnaround time and average waiting time for all the processes.

### **Task 2 (Code and Report):**

Illustrate the importance of process management by implementing a shared buffer with a maximum size of 5 slots for integer data. Implement a solution to the producer-consumer problem with the following specifications:

1. There are two types of processes: producers and consumers.
2. Multiple producers can produce items concurrently, and multiple consumers can consume items concurrently.
3. The buffer can hold a maximum of 5 items at a time.
4. Producers and consumers must synchronize to ensure the correct functioning of the buffer.

### **Specifications:**

- **Buffer Size:** 5 slots
- **Number of Producers:** 2

- **Number of Consumers:** 3
- **Producer Speed:** Each producer produces an item every 2 seconds.
- **Consumer Speed:** Each consumer consumes an item every 3 seconds.
- **Producer 1:** Will always writes integer values from 1 to 3.
- **Producer 2:** Will always writes integer values from 4 to 6.
- **Consumers:** read and Print the value on terminal.

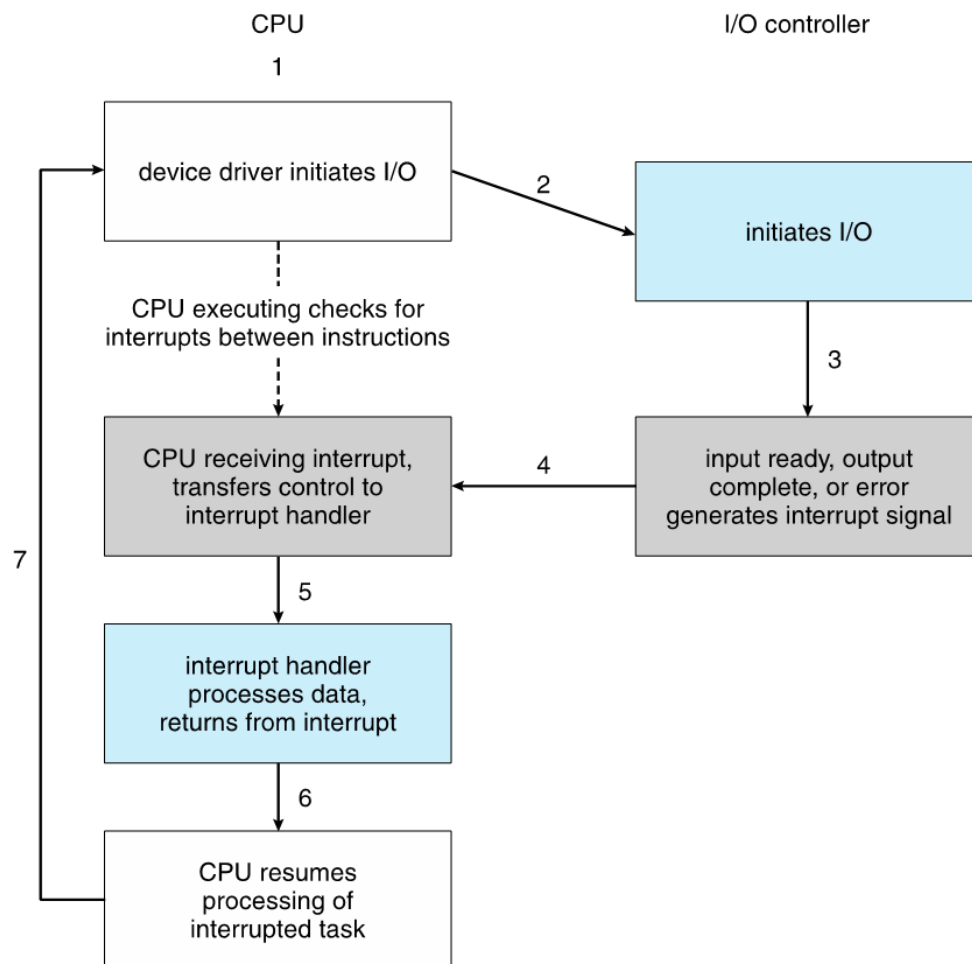
### Instructions:

1. Using C language under Linux, implement a solution to the producer-consumer problem using synchronization mechanism that we used in the lab. **(Code)**
2. Provide a diagram to show relationships between processes. **(Report)**

### Task 3 (Report):

In reference to the below figure, rearrange the following points to show their sequence in action and describe what are they and what is the OS role in each one of them:

- Interrupt Service Routine.
- Device driver.
- Interrupt signal.
- Interrupt vector table.



### Task 4 (Report):

Research the evolution of the operating system scheduler, specifically in Multilevel Queue and Multi level feedback queue, what are their benefits over the traditional scheduling algorithm mentioned in Task 1.

### Task 5 (Report):

suppose you have the following two C programs:

prgram1.c

```
#include <stdio.h>

int main()
{
    int n;
    scanf("%d",&n);

    if(n > 0)
    {
        function1();
    }
    else
    {
        function2();
    }

    return 0;
}
```

function1.c

11110000

function2.c

00001111

program2.c

```
#include <stdio.h>

int main()
{
    int n;
    scanf("%d",&n);

    if(n > 0)
    {
        function3();
    }

    function4();

    return 0;
}
```

function3.c

1010 1111

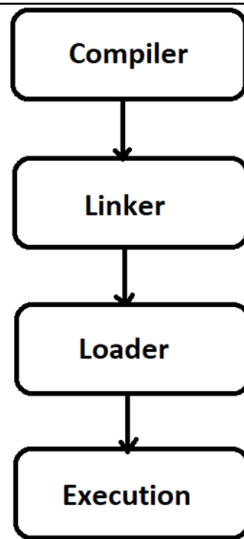
function4.c

1010 0000

Program1 will use function1 and function2 which their implementations are available in two different files, also Program 2 will use function3 and function4 which their implementations are available in two different files.

**Hint:** functions 1,2,3 and 4 are not shared functions, they are implemented by the programmers, but scanf function is a shared function for any C programmer.

Dynamic linking and dynamic loading are techniques used in operating systems to improve program efficiency and flexibility; you need to discuss their importance by answering the following questions according to the stages showed in the below figure:



1. What will happen during the stages if we didn't apply dynamic linking and dynamic loading.
2. What will happen during the stages after if we apply dynamic linking and dynamic loading.

Learning Outcomes and Assessment Criteria			
Learning Outcome	Pass	Merit	Distinction
<b>LO1</b> Investigate different Operating Systems, their functions and user interfaces.	<b>P1</b> Explore what an Operating System is. <b>P2</b> Research the evolution of Operating Systems.	<b>M1</b> Discuss the importance of Operating Systems.	<b>D1</b> Critically evaluate the functionality, interface design and processes of a range of operating systems.
<b>LO2</b> Explore the processes managed by an Operating System.	<b>P3</b> Research the process of Memory Management in an Operating System <b>P4</b> Investigate the process of job scheduling.	<b>M2</b> Analyse, with the aid of a diagram, the importance of Resource Management in an Operating System to aid its efficiency.	
<b>LO3</b> Demonstrate the use of DOS, Windows, UNIX and Linux.	<b>P5</b> With an aid of screenshots, prove the use of MS-DOS and Windows. <b>P6</b> With an aid of screenshots, prove the use of UNIX and Linux and MacOS.	<b>M3</b> Justify the security of each operating system discussed in P5 and P6.	
<b>LO4</b> Analyse appropriate techniques and technologies used in distributed and concurrent systems.	<b>P7</b> Discuss distributed Operating Systems. <b>P8</b> Discuss Concurrent Operating Systems.	<b>M4</b> Justify which techniques and technologies you would use in a Distributed Operating system.	<b>D2</b> Critically evaluate your work and make some recommendations about current Operating Systems and future advancements.

## STUDENT ASSESSMENT SUBMISSION AND DECLARATION

When submitting evidence for assessment, each student must sign a declaration confirming that the work is their own

<b>Student name:</b>	<b>Assessor name:</b>	
<b>Issue date:</b> 30/11/2023	<b>Submission date:</b> 29/01/2024	<b>Submitted on:</b>

**Programme:** Computing

**HTU Course Name:** Operating Systems  
**HTU Course Code:** 40201341

**BTEC Course Title:** Operating Systems  
**BTEC Course Code:** R/615/1700

**Assignment number and title:** 1, Assignment 1

### Plagiarism:

Plagiarism is a particular form of cheating. Plagiarism must be avoided at all costs and students who break the rules, however innocently, may be penalised. It is your responsibility to ensure that you understand **correct referencing practices**. As a university level student, you are expected to use appropriate references throughout and keep carefully detailed notes of all your sources of materials for material you have used in your work, including any material downloaded from the Internet. Please consult the relevant unit lecturer or your course tutor if you need any further advice.

**I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.**

**Student Name:**

**Student Signature:**

**Date:**