SIT111 Learning Summary Report

PART ONE: Self-assessment of your learning in SIT111

Please fill the tables below. You may delete tables that are not relevant for your grade.

What is the grade you are applying for?

	Pass (P)	Credit (C)	Distinction (D)	High Distinction (HD)
Self-assessment (please tick>	✓	✓		

Minimum Pass Checklist

Tasks	Included (please tick)	Comments on the quality of your submissions (Optional)
1.1P	X	What I would like to stress on is that I was always submitting the work on time, thus, meeting all of the due dates in the course, to back up my request for the desired grade. In addition, I have successfully completed all the C-level work and for P grade, I have also showed commitment by striving to get a better understanding of the work done in hope of a better numerical value. Furthermore, I have had to ask for an extension for some P jobs because of some issues like health complications. Nonetheless, I have been able to avoid these difficulties resulting in maintaining my concentration, and improving the quality of the work in a regular basis by engaging with the course material, and practicing in the abilities and information that I have been developed.
1.2P	X	
1.3P	X	
2.1P	X	
3.1P	X	
4.1P	X	
1.5P	X	
1.6P	X	
2.1P	X	
3.1P	X	
3.3P	X	
3.4P	X	
3.6P	X	

Minimum Credit Checklist

Tasks	Included (please tick)	Comments on the quality of your submissions (Optional)
3.2C	X	When applying for the grade I would like to earn, I would like to bring my instructor's attention to matters like timely submission of the assignments, as a show of responsibility and effective time management throughout the course. Some of the D-level assignments that I have completed also show my ability to engage with the content at a higher level, though, and may help me earn a better numerical value for my P grade. Besides, due to an unexpected health issue, I got an extension for one C-level work. I still however did not give up, in engaging with the course material and kept going at it to the best of my abilities in order to complete the said assignment.
3.2C	X	
3.5C	X	

Minimum Distinction Checklist

Tasks	Included (please tick)	Comments on the quality of your submissions (Optional)
		<you may use this space to briefly strengthen your case for the target grade. - For example, consistent submission of tasks on time, anything else..? If you were granted extensions for one or more D tasks due to something unavoidable such as a medical issue – this is a good place to mention this >

Minimum High Distinction Checklist

Tasks	Included (please tick)	Comments on the quality of your submissions (Optional)
		<you may use this space to briefly strengthen your case for the target grade. - For example, consistent submission of tasks on time, anything else..?>

PART TWO: Retrospection on your learning in SIT111

The most important things I learnt:

In this unit, I was able to apply basic concepts in electronic by learning how to interface microcontrollers with different sensors and components. Signal and its types, usage of breadboard and the difference between the analog and the digital signals was clear to me. In Arduino's IDE, I programmed with C/C++, and I found that it enhanced my coding skills in abetting the output based on the input of the sensors. I also learned problem solving skills by solving circuits when part were damaged or when the connections were incorrect. Finally, integrating different modules: LEDs, motors, and sensors enlarged my knowledge of how the hardware works with software.

I found the following topics particularly challenging:

The most challenging aspect of the Arduino circuit unit was to grasp and apply numerous communication standards such as I2C and SPI, which required a broader notion of how data is communicated between modules. Controlling power supply in circuits was another challenge especially dealing with several components that require different volts of supply. Like in any conventional system, small issues such as loose connections or incorrect resistor value could halt the whole system hence debugging of faulty circuits was also difficult. Other challenges were extra coding where details mattered for a sequence such as LCD screens or servo motors. Finally, the complex mathematical calculations were required to accommodate the integration of the sensors with nonlinear data acquisition, i.e., temperature sensors.

I found the following topics particularly interesting:

I found the integration of several sensors and actuators to be the most stimulating mostly because it provided concrete applications of the Internet of Things (IoT). Arduino is an interesting and fand programming gadgets that is capable of being controlled by inputs in the environment. PWM control of brightness of LEDs and speed of motors also fascinated me as well as solving problems using analog signals of amplitude modulators. I also found it interesting to see how different sensors like infrared and ultrasonic sensors work because it related the learning contents to practice. I was able to stay interested the whole time because of unveiling of Arduino projects in terms of the creativity the projects which include automation.

The things that helped me most were:

I have learned important facts about difficult subjects through the highly detailed documentation available for Arduino and helpful forums online. The learning was enhanced and the theoretical concepts made more understandable via physical testing with breadboards and parts. My understanding was also improved as I was able to work with classmates, to discuss topics and generate solutions. I described the circuits on the paper and simulated them through Tinkercad before physically developing them thus minimizing on time and mistakes made. In addition, information from my instructor was helpful in giving students advice when solving complex problems starting from lectures to the laboratory practical lessons whereby my instructor would expound on the essence of the topic as well as practical methods to use if I faced some challenges solving the problems at hand.

If I did this unit again, I would do the following things differently:

Where I to redo this particular unit, I would ensure that I recorded this endeavour more systematically as well as take tolerable notes mainly with regard to wiring as well as coding alterations. I considered that I would be able to track errors more successfully with this. I would also focus on ensuring the fundamentals of circuit theory comprehensively because this would make me prepare a better foundation before attempting such other tasks. Besides, since protocols such as SPI and I2C are fundamental to more comprehensive projects, I would spend more time studying them. Finally to challenge myself and expand the range of available projects I would work with progressively more complex Arduino shields and modules.

SIT111 – Task 1.1P
Learning Plan

1. **Reflecting on your understanding of the unit, and you're learning goals, describe your learning plan for this unit. You must include the following:**

   a. Your target grade for SIT111
   - Target Grade: High distinction (HD)

   b. How much time outside out scheduled learning sessions that you hope to spend studying, Andon what days you hope to engage in studying.
   - I addition to the designated learning sessions, I want to commit at least 15 hours every week. To guarantee consistent interaction with the content, I try to split up this time between the weekdays and weekends.
     - Monday to Friday: 2hours each day
     - Saturday and Sunday: 5Hours each day

   c. What specific strategies/methods you hope to employ (e.g. self-study using provided unit ma-trials, discussions with friends, reading text books, taking short notes, practicing problems, participating in unit discussion forums etc.)
   - Self-study:
     - I will make use of the unit materials—lecture notes, textbooks, and internet resources—to enhance my comprehension of the main ideas.
   - Reading Textbook:
     - To have a thorough grasp of the material, read extensively from suggested texts in addition to the lectures.
   - Taking short Notes:
     - In my own words, summarize important ideas and points to help with recall and speedy review.
   - Practicing Problems:
     - To improve problem-solving abilities, practice issues frequently and apply theoretical knowledge to real-world situations.

d. What you perceive as challenges to achieve your grade and what you hope to do to overcome them

- Challenge: Possibility of trouble with time management.
  - Solutions: For effective time management, create a thorough study plan, assign work in a timely manner, and divide more complex subjects into smaller, more digestible chunks.

- Challenge: Conquering difficult ideas.
  - To improve understanding and obtain new insights, look for more resources, participate in tutorials, and work with peers.

SIT111 - Task 1.2P Boolean Expression to Truth Table

Complete the truth tables for the following Boolean expressions.

a. NOT (P) OR NOT (Q)

P	Q	NOT (P)	NOT (Q)	NOT (P) OR NOT (Q)
0	0	1	1	1
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

b. (P AND Q) OR (NOT (P AND Q))

P	Q	P AND Q	NOT (P AND Q)	(P AND Q) OR (NOT (P AND Q))
0	0	0	1	1
0	1	0	1	1
1	0	0	1	1
1	1	1	0	1

c. P AND (Q OR R)

P	Q	R	Q OR R	P AND (Q OR R)
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	1	0
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

SIT111 - Task 1.3P Truth Table to Canonical Representation

• Formulate the relevant Boolean expression, in Canonical Form for the truth table given below. Do not simplify the expression.

P	Q	R	F (P, Q, R)	
0	0	0	1	P'Q'R'
0	0	1	0	
0	1	0	1	P'QR'
0	1	1	0	
1	0	0	1	PQ'R'
1	0	1	0	
1	1	0	0	
1	1	1	1	P'Q'R'

- Combine the minterms using OR operations
  f (P,Q,R) = (P' * Q' * R') + (P' * Q * R') + (P * Q' * R') + (P * Q * R)

  f (P,Q,R) = (NOT(P) AND NOT (Q) AND NOT (R)) OR (NOT(P) AND (Q) AND NOT (R)) OR ((P) AND NOT (Q) AND NOT R)) OR ((P AND (Q) AND R))

SIT111 - Task 2.1P Implement and Test the Mux in HDL

Overview

A simple multiplexor (Mux) is a three-input gate that uses one of the inputs, called 'selection bit', to select and output one of the other two inputs, called 'data bits'. In this task, you are given the design of a Mux using a collection of primitive Nand gates. Nand gate is called a 'universal gate' because it can be used to build all other gates.

Your task is to implement the given design using Hardware Description Language (HDL).

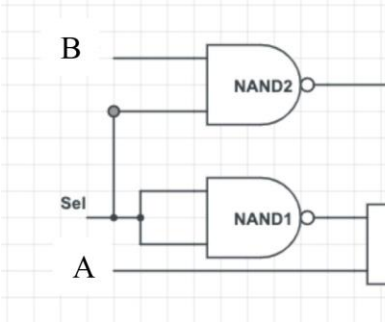
Task requirements

a. Go through week 2 class materials on Google Classroom & complete the practice problems.

b. Read the task instructions

Task Instructions

1. Using your knowledge gained from the learning materials and learning sessions in week 2, write an HDL program to implement the given Mux design in Figure 1 below. The truth table is also given below.



Sel	A	B	Out
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Figure 1: Diagram of Mux designed from NAND gates and Truth Table

2. Upload the script to the Hardware Simulator tool that is provided.
3. Run and validate your HDL program with the test scripts provided in this task, to test your implementation. (refer to the learning materials on how to do this)
4. Your submission is the HDL program (a .hdl file).

Reference

Nisan, Noam, and Shimon Schocken. The *Elements of Computing Systems : Building a Modern Computer from First Principles* MIT Press, 2005.

SIT111 - Task 3.1P Implement the Full Adder in HDL

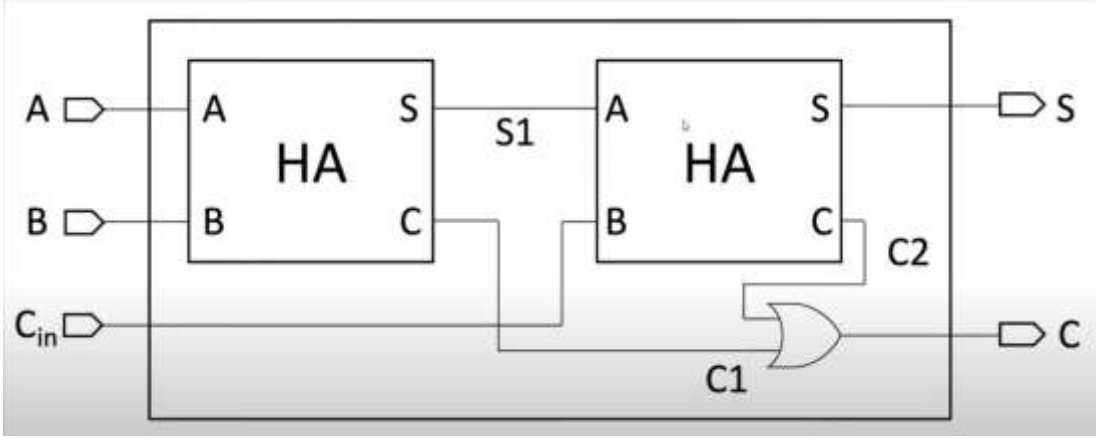
- Using one OR gate and two half adders, I implemented the full adder. However, I had to use an AND gate and Xor to implement the half adder first.

  HALF ADDER
  Xor (a=a, b=b, out=sum);
  And (a=a, b=b, out=carry);

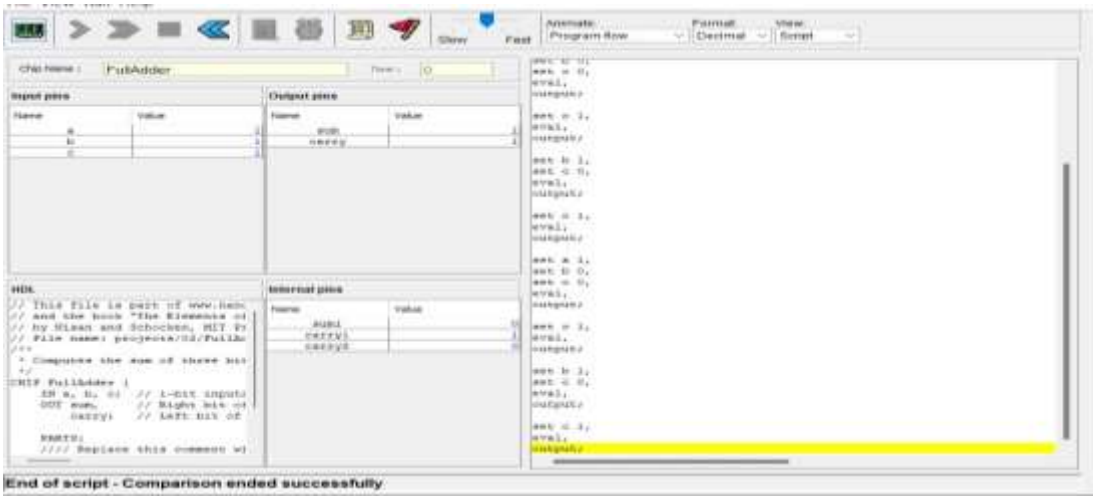
- After that, I utilised one OR gate, two half adders, and the script file for a full adder.

  FULL ADDER
  HalfAdder (a=a, b=b, sum=sum1, carry=carry1);
  HalfAdder (a=sum1, b=c, sum=sum, carry=carry2);
  Or (a=carry1, b=carry2, out=carry);

- The whole implemented adder's diagram is available here.

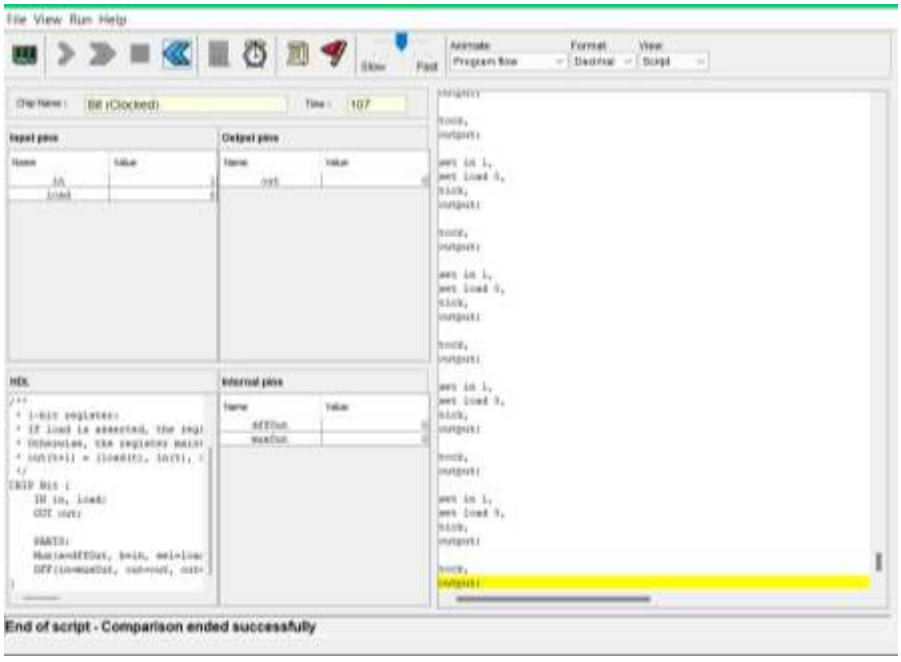


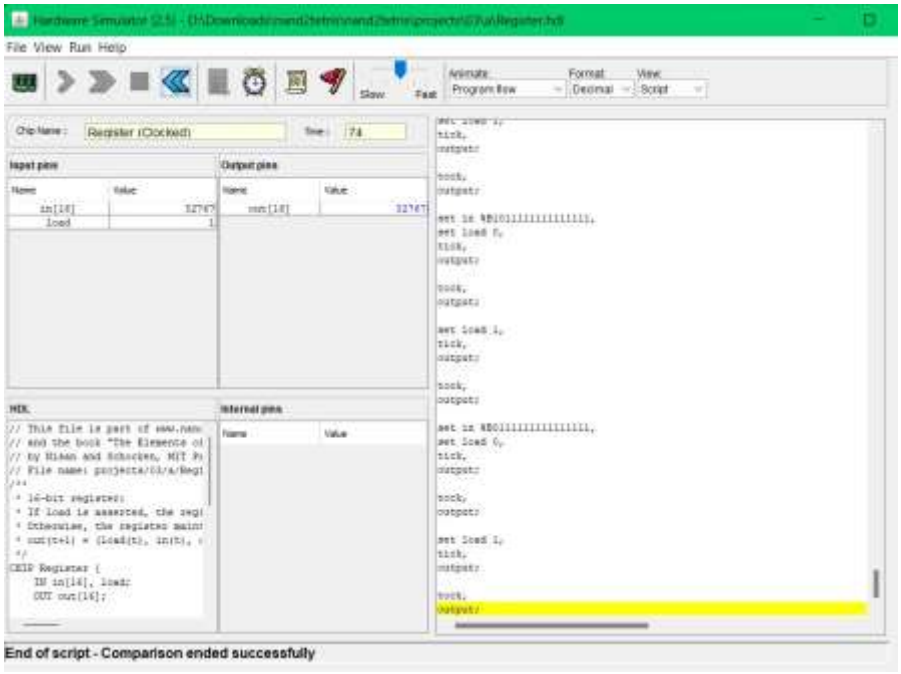
- Three inputs are needed for the complete adder: a, b, and c. The inputs of the first half adder are a=a and b=b, while the outputs are carry1 and sum1. The second half adder outputs the sum and carry2 after receiving inputs as a=sum1 and b=c. Next, two inputs are fed into the OR gate: b=carry2 from the second half adder and a=carry1 from the first half adder. outputs out=carry in the end. Thus, in total, it receives three inputs and produces two, which are the sum and carry. The file loaded and executed flawlessly in Nand Tetris. The page is provided below.


Slow
Fast
Animate:
Program flow
Format:
Decimal
View:
Script
Chip name :
FullAdder
Input pins
Output pins
HDL
Internal pins
End of script - Comparison ended successfully

Task 4.1P Implement 16-bit register in HDL

- To build this 16-bit register, I used the Nand Tetris hardware simulator's HDL programming.
- 16 single-bit register arrays are formed to produce this.
- After that, joining them to create the 16-bit register.
- There is a DFF and a Mux in the 1-bit register.
- The chip interface is made up of an output pin that outputs the cell's current state, an input pin that carries a data bit, and a load bit that allows the cell to be written to.
- After that, in order to fully implement the 16-bit register, I had to construct 16 arrays of 1-bit registers and connect them to one another in the 16-bit register HDL file.
- Using bus syntax, the in [0] and out [0] bits are connected, and this connection process is repeated up to the 16th bit. To put it another way, bus syntax links the input bit in [0] to the output bit out [0], and this connection is maintained progressively up to the 16th bit.
- After that, launch the Hardware Simulator and load the test file and 16-bit register HDL file.
- The comparison concluded satisfactorily, demonstrating the successful creation of a 16-bit register.




File View Run Help
Slow
Fast
Animate:
Program flow
Format:
Decimal
View:
Script
Chip name:
Register (Clocked)
Time:
74
Input pins
Name
Value
in[16]
32767
load
1
Output pins
Name
Value
out[16]
32767
HDL
Internal pins
Name
Value
// This file is part of www.nan
// and the book "The Elements of
// by Nisan and Schocken, MIT Pr
// File name: projects/01/a/Regi
/**
* 16-bit register:
* If load is asserted, the regi
* Otherwise, the register main
* out(t+1) = (load(t), in(t), o
*/
CHIP Register {
IN in[16], load;
OUT out[16];
set in %B1111111111111111,
set load 0,
tick,
output;
tock,
output;
set load 1,
tick,
output;
tock,
output;
set in %B0111111111111111,
set load 0,
tick,
output;
tock,
output;
set load 1,
tick,
output;
tock,
output;
End of script - Comparison ended successfully

Question 1 (1 point)

What is the primary role of a file system in a computer?

1) To enhance the graphics of the computer.

2) To cool down the storage drives by regulating the temperature based on data load and usage.

3) To organize data into files and directories for easy access and management.

4) To increase the speed of file download over the internet.

5) To supply power to the computer components.

6) To process audio signals.

Question 2 (1 point)

Which of these is NOT a type of file system?

- 1) FAT (File Allocation Table).
- 2) NTFS (New Technology File System).
- 3) ext4 (Fourth Extended Filesystem).
- 4) HFS+ (Hierarchical File System Plus).
- 5) ATP (Advanced Technology Partition).
- 6) VHD (Virtual Hard Disk).

Question 3 (1 point)

What is the purpose of file permissions in a file system?

1) To determine the speed at which a file can be accessed and processed within the system.

2) To control who can read, write, or execute a file.

3) To control the graphical quality and resolution of image and video files stored on the computer.

4) To dictate the rate of data transfer over the network for specific files, enhancing or limiting their upload and download speeds.

5) To manage the allocation of storage space on a hard drive, determining how much space a file can occupy.

6) To boost the processing speed of the file system.

Question 4 (1 point)

Scenario:
Alex, a student, has recently installed VirtualBox and set up a new Ubuntu virtual machine for a class project. However, upon starting the virtual machine, Alex notices that the VM is running extremely slowly and lagging, making it difficult to work on the project. The VM's performance issue is hindering Alex's ability to use software applications efficiently.

Alex thinks that the virtual machine's poor performance and lag are likely due to insufficient resources allocated to the VM.

Select the statements that describe some options Alex could try to resolve the issue.

Options:

- [ ] 1) Reinstall the Ubuntu operating system in the VM to reset its settings.
- [x] 2) Increase the RAM allocated to the VM.
- [ ] 3) Defragment the hard drive of the host machine to speed up the VM.
- [x] 4) Allocate more CPU cores to the VM if the host system has enough processing power.
- [x] 5) Switch the VM's display settings to a lower resolution.
- [ ] 6) Delete and recreate the VM with a different operating system.

Question 5 (1 point)

Which software is used to create and manage Virtual Machines?

- [ ] 1) Adobe Photoshop.
- [ ] 2) VirtualDJ.
- [x] 3) VirtualBox.
- [ ] 4) Windows Media Player.
- [ ] 5) VMWare.
- [ ] 6) Virtual Hard Disk.

Question 6 (1 point)

Scenario:
Alex, a university student, is using VirtualBox for a computer science project. She needs to frequently transfer project files between her Windows laptop (host OS) and a Linux virtual machine. Alex finds it cumbersome to use external drives or email for this purpose and is looking for a more efficient method to share files directly between the host OS and the VM.

Question:
What can Alex do to streamline the file-sharing process between her Windows host OS and the Linux VM in VirtualBox? Select correct options from below:

- [x] 1) Alex can configure a shared folder in VirtualBox's settings, enabling direct file access between the host OS and the VM without external tools.
- [x] 2) Utilize the drag-and-drop feature in VirtualBox (after installing Guest Additions) to easily transfer files between the host and the VM.
- [ ] 3) Install a separate file conversion software on the VM to convert and transfer files to the host OS.
- [ ] 4) Use a dedicated graphics card in the VM to enhance file transfer speeds between the host and VM.
- [x] 5) Set up network file sharing within the VM, allowing it to access specific folders on the host OS over the network.
- [ ] 6) Establish a VPN connection between the host and VM, as it will directly enable file sharing.

Question 7 (1 point)

What is the primary advantage of using Virtual Machines?

- ( ) 1) They increase the physical storage capacity of the host computer by creating additional virtual hard drives.
- (•) 2) They allow running multiple operating systems simultaneously on one physical machine.
- ( ) 3) They enhance the graphics processing capabilities.
- ( ) 4) They improve the computer's sound quality.
- ( ) 5) They speed up the internet connection.
- ( ) 6) They act as an advanced firewall, significantly enhancing the host computer's security against cyber threats and malware.

Question 8 (1 point)

Which of the following statements regarding ISO images are true in the context of VMs?

- [ ] 1) They are used for increasing the speed of the VM.
- [ ] 2) They function as a backup system within VMs, automatically saving copies of all files and settings at regular intervals.
- [x] 3) They are used for optical disk images like CDs and DVDs.
- [x] 4) They are used as the source media for installing operating systems or software within the VM
- [ ] 5) ISO images are used to increase the virtual memory capacity of VMs, providing additional space for data storage and processing.
- [ ] 6) ISO images are used for physical hardware modifications.

Question 9 (1 point)

What are the main differences between a physical machine (PM) and a virtual machine (VM)?

- [ ] 1) PMs can run several operating systems at once, unlike VMs.
- [ ] 2) PMs share host machine resources, while VMs use all resources exclusively.
- [x] 3) PMs deliver higher performance for demanding tasks due to direct access to hardware, whereas VMs might have reduced performance due to virtualization.
- [ ] 4) VMs incur higher hardware and maintenance costs, unlike PMs which are more cost-effective.
- [ ] 5) Scaling VMs usually needs more physical hardware, but PMs are easily scalable without extra hardware.
- [ ] 6) PMs directly use all available resources for improved task performance, while VMs share resources and may perform less efficiently due to shared resources.

Question 10 (1 point)

Why is VirtualBox popular for creating Virtual Machines?

- [ ] 1) It can increase the physical memory of the computer.
- [x] 2) It is a powerful virtualization product available for free.
- [ ] 3) It automatically speeds up the internet connection.
- [ ] 4) It can physically alter the computer hardware.
- [ ] 5) It enhances the graphics of games.
- [x] 6) It runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of guest operating systems.

Question 11 (1 point)

In VirtualBox, what is the purpose of the 'Guest Additions' feature?

- ( ) 1) To increase the storage capacity of the VM.
- (x) 2) To improve performance and add functionality like seamless mouse integration.
- ( ) 3) To enhance the internet speed in the VM.
- ( ) 4) To act as a firewall for the VM.
- ( ) 5) To improve the sound quality in the VM.
- ( ) 6) To add guest logins in the VM.

Question 12 (1 point)

Which of the following is true about disk images in VMs?

1) They are mainly used for graphic design.

2) Disk images act as a virtual hard drive for the VM.

3) They are used to cool down the VM.

4) Disk images are used to boost the VM's internet speed.

5) They enhance the audio processing of the VM.

6) They are used to physically modify the VM.

Question 13 (1 point)

What is the main purpose of using snapshots in VirtualBox?

1) To increase the storage space of the VM.

2) To capture the current state of a VM for restoration purposes.

3) To enhance the graphical capabilities of the VM.

4) To enable taking screenshots in the VM.

5) To upgrade the operating system of the VM automatically.

6) To act as a power management tool for the VM.

Question 14 (1 point)

How does virtualization benefit data centres?

- [ ] 1) It allows for playing high-end games in the data centre
- [x] 2) It facilitates server consolidation and improves resource utilization.
- [ ] 3) It is used for creating physical connections between servers.
- [x] 4) Virtualization provides improved disaster recovery and business continuity solutions, as virtual machines can be easily backed up, replicated, and restored on different hardware in case of failures or maintenance.
- [x] 5) It enables better scalability and flexibility, as virtual servers can be quickly created, deployed, or reconfigured to meet changing demands without the need for physical hardware changes.
- [ ] 6) It increases the physical storage capacity of each server.

Question 15 (1 point)

Which of the following statements are true regarding 'sectors' in a hard drive?

- [x] 1) Sectors are the smallest unit that can be read from or written to on a hard drive.
- [x] 2) They are fixed-size segments on the hard drive's platters where data is stored.
- [ ] 3) Sectors are organized into larger groups called tracks on the surface of the hard disk platters.
- [ ] 4) The size of a sector in modern hard drives is typically 512 bytes or 4K bytes.
- [x] 5) Sectors are crucial for the hard drive's ability to locate and retrieve data efficiently.
- [x] 6) Over time, sectors can become 'bad' or unusable, requiring the hard drive to remap the data to spare sectors.

Task 1.5P -Introduction to File Systems and Virtual Machines

Introduction

- Concepts Review: Once more, I described the role of files, directories, and permissions into file system. As these are the building blocks of each operating system data structure, access, and security it is crucial to understand all of them.

File Exploration. File Explorer Analysis:

- Operating System: Using Windows 11 was the operating system I was employing. When engaging in browsing these four directories; “Pictures,” “Documents,” “Program files,” and “Windows,” I searched.
- Options for File Types: I saw a variety of file types, including:

✓ Image - .png
✓ Text - .txt
✓ Executable - .exe
✓ System data file - .sys

- Extensions and Features: As was mentioned above and could be remembered, the files with the executable code are usually presented by files with the.exe extension while system files are normally hidden by default as they are the part of the operating system.

Directory Structure Analysis. Default Organization:

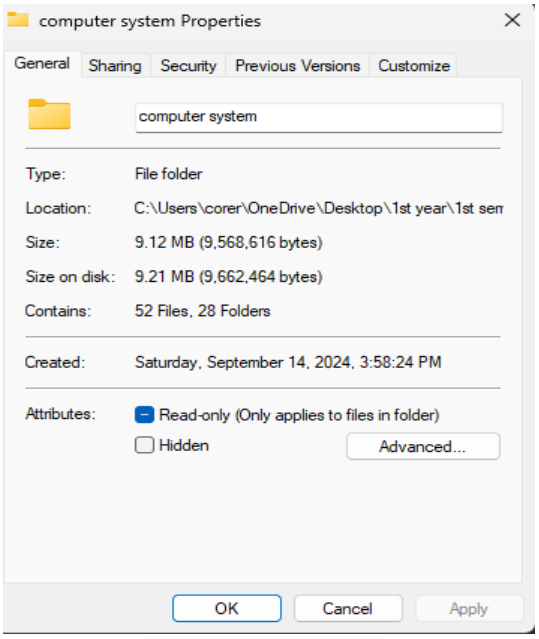
- This folder called “Program Files” where folder is categorized by application and it contains subfolders for various versions or part of applications installed in the computer.
- What I noticed was that there are default folders that the operating system creates and assigns labels such as; Documents, Music, Pictures. In order to prevent the files of the system to undergo simple modification, passwords are created to secure the directories where the files are stored.

File Permissions Investigation. Permission Analysis:

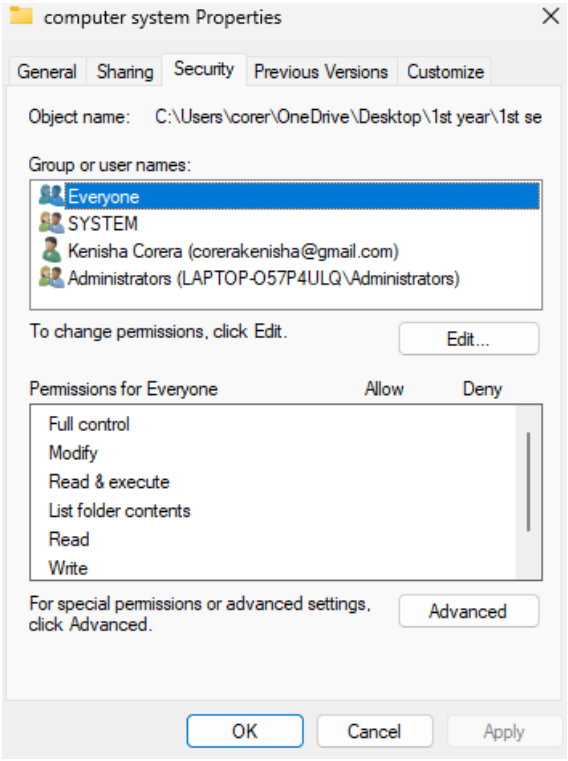
- Modification Attempt: I had tried to change the permission setting of an innocuous hypertext file. Permission settings plays a crucial role in security since one has to get an administrator approval to change the permission.
- Contemplation of Permissions: Access authorities play a very important role in system’s security because they can specify the amount of openness of certain procedures for some people. It supports its function to avoid various modifications that can compromise the system’s performance.
- Permissions Verified: I compared the attributes of these files in various folders. As a rule, only administrators are able to change files within the system.

Documentation of Findings. Observations Recorded

File Properties



File Permissions



- Most of them are hidden and protected through the system by default, which kind of shocked me and underlines their significance within the operating system.

Analyzing Real-World Applications of Various File Systems

NTFS

- Historical Development as of NT OS 3, NTFS was released by Microsoft in 1993 for use in Windows NT 3.1 as a new filesystem to replace the old FAT. Technical Details Moreover, NTFS could support disk quotas and additional files attributes like compression and encryption, volumes that are large, and file name extended. Usage Scenarios NTFS is in widespread use in all types of Windows OS, home and business, owing to its stability and top-shelf feature set.

Real-World Applications Case Studies:

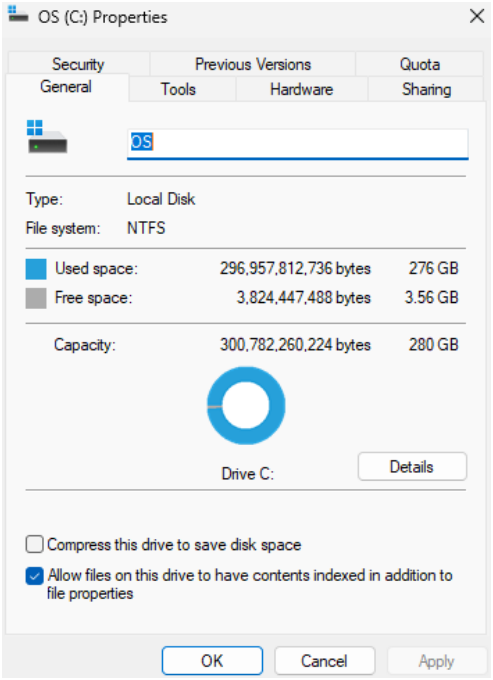
- Sur it is better to go with NTFS in commercial situations when data security, its irre CAD integrity and effective storage administration are paramount. And due to the logging capability that helps to avoid data corruption NTFS for instance is suitable for servers and databases.

Comparative Analysis. Comparison with FAT32

- Preference scenarios: That is why FAT32 is best used in cross platform situations like USB peripherals, however NTFS is preferred in cases where file size and data integrity are an issue.
- FAT32 is much easier and can be used on non-windows operating systems as much as possible even though NTFS is the recommended format for new windows computers due to efficiency, security and the ability to address large files and partitions.

Discussion and Feedback. Reflection on Discussion

NTFS Features in C drive



Comparative analysis Table

FEATURE	FAT32	NTFS
Max.Partition Size	2TB	2TB
Max.File Name	8.3 Characters	255 Characters
Max.File Size	4GB	16TB
File/Folder Encryption	No	Yes
Fault Tolerance	No	Auto Repair
Security	Only Network	Local and network
Compression	No	Yes
Conversion	Possible	Not Allowed
Compatibility	Win 95/98/2K/2K3/XP	Win NT/2K/XP/Vista/7

- Nevertheless, if necessary to operate the system with other systems, NTFS coping with complexities, however might not represent the optimal choice.

Summary

- Through the research, I was able to understand fully the workings of the virtual machines and the file systems that exist in a computer environment. File systems therefore act as the core in data management by providing structures of directories and files and methods facilitating secure and efficient retrieval of data. I was enlightened on numerous file systems- NTFS, FAT, ext4, HFS+ among others, which have special attributes suited the operating systems they support. For instance, Linux systems select ext4 file system just due to the stability and speed, whereas Windows employs NTFS most broadly because of its security measures and ability to work with very large files. It was therefore very enlightening when it showed how important it is to secure the system, regulate access to files as well as, prevent unauthorized alteration to files. On the other hand, virtual machines which only provide an additional layer or a 'virtual' computer can accommodate many operating systems within one physical computer. I discovered that virtual machines are good for testing and development environments and can also, if needs be, get the most out of hardware, with many environments running from a single server. Also included in this information is a discussion of how important they are for mimicking the role played by a physical machine while at the same time offer the host machine a completely different and secure environment. Most compelling were such ideas as, for instance, hypervisors – components that control the virtual machines and show the advantages of virtual machines for modern computing.

Reflection

- Today I am able to confidently explain and evaluate how different file systems operate as well as how virtual machines in computing function and therefore I am sure that I have comprehended all the learning objectives. I learned the most important lesson from this experience: file permission and security are essential parameters overriding the data integrity as well as system performance. I am now aware of the conceptual foundation for system security because of the knowledge I have gotten from the structure of permission and its functionality on various file systems. Namely, my previous knowledge of operating systems and data management is directly related to the gained new information from the course. This course expanded my knowledge by indicating the peculiarities of numerous file systems with relevant aspects and the use of virtual machines. The lesson will be very beneficial for me in my further work both in systems administration or any other post connected with IT, especially if it is necessary to manage several settings or to provide data protection. The knowledge in computers and skills mastered will be important while diagnosing file system issues or while setting up secure file systems and V.Ms or while trying to optimize resource utilization while installing V.Ms for independence application testing.

Task 1.6P - Job Awareness in IT

1. Computer Architecture

✓ **Job Title:** IT Support Technician

✓ **Organization:** XYZ Tech Solution

✓ **Key Skills:**
- Setting up and adjusting computer systems.
- Identifying and fixing software and hardware issues.
- Ability to communicate technological issues to non- technical users.
- The ability to multitask and manage time.

✓ **Related Computer Architecture Skills:**
- Capacity to troubleshoot hardware elements such as memory modules models and CPUs
- Knowledge of bottlenecks in system performance

XYZ Tech Solution
https://www.xyztechnologies.com/en/careers/

2. **Operating Systems**

✓ **Job Title**: System Administrator

✓ **Organization**: TechCorp Solutions

✓ **Key Skills**:
- Managing and implementing systems.
- Controlling the Linux and Windows operating systems.
- Managing user accounts and controlling access.
- Procedures for backup and recovery.

✓ **Related Operating Systems Skills**:
- Controlling file systems, memory and process scheduling.
- Controlling operating system installations and virtual machine management.
- Understanding of kernel-level configurations and system calls.

https://www.topjobs.lk/applicant/vacancybyfunctionalarea.jsp?FA=HNS

3. **Hardware**

✓ **Job Title:** Hardware Engineer

✓ **Organization:** ABC Electronics Ltd.

✓ **Key Skills:**
- Precision and attention to detail when putting systems together and taking them apart.
- Hardware diagnosis and troubleshooting for computers.
- Hardware Prototype and soldering.
- Understanding of the architecture of microcontrollers.

✓ **Related Hardware Skills:**
- Updating and swapping out system parts.
- Recognizing the many kind of hardware parts and how they work.
- Finding and resolving hardware problems such as faulty parts.

https://www.linkedin.com/company/abc-electronics-limited/about/

Job Title and Organization	Key Skills	Computer Architecture/Operating System/Hardware Skills (required for the job
IT Support Technician (XYZ Tech Solution)	Problem Solving, Technical analysis.	Troubleshooting, CPU design knowledge, System configuration.
System Administrator (TechCorp Solutions)	System Administration, Software management.	Scripting Virtual machine.
Hardware Engineer (ABC Electronics Ltd.)	Hardware maintenance.	Diagnosing hardware issues.

Task 2.1P - Virtual Memory and File Systems

Section 1: Summary

Virtual Memory:

An approach to memory management that provides the illusion of an unending block of memory, even when there is inadequate real memory available. Converting virtual addresses to physical addresses occurs by means of a combination of hardware and software.

- ✓ Page replacement Algorithms
- ✓ Paging
- ✓ Page Tables
- ✓ Demand Paging

File Systems:

An operating system organizes, manages, and stores files and directories on a storage medium by means of a file system. A few regular file system types including;

- ✓ NTFS (New Technology file System)
- ✓ APFS (Apple file System)
- ✓ FAT (File Allocation Table)
- ✓ EXT (Extended file System)
- ✓ HFS (Hierarchical File System)

Section 2: Reflection

1. How do you know you have achieved the learning goals?
    - ✓ Successfully communicating and exploiting file systems and virtual memory concepts have helped me meet my learning targets. I can explore both file systems and their data management, alongside the way virtual memory improves system functionality. Being able to answer inquiries, sort through challenges, and bring these ideas into real practice validate my grasp and achieve the intended learning goals.

2. What is the most important thing you learned from this and why?
    - ✓ The foremost thing to notice is that virtual memory enhances system velocity and multitasking by making it possible to run multiple apps at once, without exhausting all the physical memory. This data is important for system administration as well as software development, because it supports both stability and efficiency in current operating systems.

3. How does the content or skills learned here relate to things you already know?
    - ✓ My grasp of computer architecture and operating systems improved thanks to this learning, which covered thorough information on paging, swapping, and inodes. Through its emphasis on how critical file systems are for data protection and forensic investigation, it improved my knowledge of memory management and data storage, enhanced my skill in software development, and enflamed my passion for cybersecurity.

4. Where or when do you think it will be useful?
    - ✓ The abilities I've gained will be helpful in a number of contexts: The purpose is to develop software more effectively by increasing program efficiency and troubleshooting capability; to back cybersecurity efforts by providing data protection services and conducting system vulnerability analysis; and to support system administration and IT support through the optimization of performance and assurance of data integrity. In common cases, such expertise is essential for charting the efficient administration and optimization of computer systems.

Quiz 4

i. 3
ii. 6
iii. 2
iv. 2 , 4 , 5
v. 3 , 5
vi. 1 , 2 , 5
vii. 2
viii. 3 , 4
ix. 3 , 4
x. 2 , 3
xi. 2
xii. 2
xiii. 2
xiv. 2 , 4 , 5
xv. All

Task 3.1P - Arduino Blinky Project

Summary

- It was quite simple to assemble a fundamental circuit for Task 3.1P, the Arduino Blinky Project using the outlined materials which included an Arduino Uno microcontroller, LED and 220Ohm resistor. The Arduino was to be programmed to toggle the LED to make it blink at intervals of one second. To control the current the resistor was placed in series with the LED and the LED base was connected to the digital pin 13 via the bread board during conduction. After configuring the hardware I wrote a program using the Arduino IDE, where even though the hardware is comparatively more advanced, I relied on basics such as pinMode and digital Write to get the LED to blink. Next, it sent the program to the Arduino, and the LED blinked the way it is supposed to. I was able to control the rate at which the blink occurred by modifying the delay parameters, In doing this, I got to learn more about time delay functions in microcontroller based systems. In light of this, this assignment was helpful in enhancing basic features such as circuits and the microcontroller necessary for other complex projects in the future.

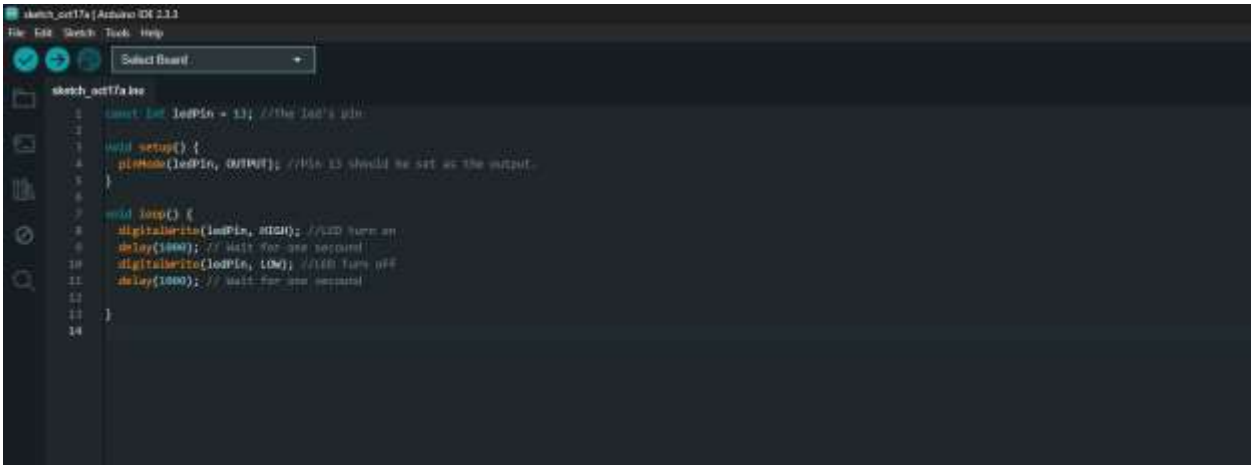
Reflection

- From this particular assignment, I was to enhance my understanding of some core electrical and programming concepts with regard to the embedded systems. I am sure that I achieved the learning objectives because I was able to assemble the circuit in a right way and make the LED to blink in a way it was assigned, that means, I was in a position to combine the software programming and the hardware assembling. The biggest takeaway I had from this project was learning how to control microcontrollers with the help of Arduino Integrated Development Environment which will be useful in electronics and IoT devices. It also enabled me appreciate how the code can be used to control specific Hardware components.

- The prior knowledge I have of programming logic and hardware, which I learned from previous logic gate and computer architecture classes is in a way linked to the skills I developed from this work. Further, it has connections with the other ideas about computing such as timing and Input/output control that are critical for real-time systems. I believe that the knowledge obtained through such work could prove useful in future work using more complicated Arduino projects or other microcontroller systems. It will also be very useful for any project that involves parts of hardware with software such as in the development of embedded systems, robotics or home automation.

Arduino Code

```
const int ledPin = 13; //The led's pin


void setup() {
  pinMode(ledPin, OUTPUT); //Pin 13 should be set as the output.
}


void loop() {
  digitalWrite(ledPin, HIGH); //LED turn on
  delay(1000); // Wait for one secound
  digitalWrite(ledPin, LOW); //LED Turn off
  delay(1000); // Wait for one secound


}
```



Drive Link

https://drive.google.com/file/d/1j4hw9fX1g8Hj_MjTCokfKToWZPrtXf1s/view?usp=sharing

YouTube Link
https://youtu.be/6MpQ1rZSZ44

Task 3.3P - Arduino LED Control via Button

Summary

- For this assignment, I created an Arduino circuit where two push buttons control two LEDs. Circuit control buttons and LEDs, there was a different Arduino digital pin and it was created on the breadboard assemblage. Using the Arduino IDE, the code was created to label the LEDs as output and the buttons as inputs. I arrange the circuit like each button was independent and connected only one LED, then I used `digitalRead()` for detecting the pushes on the buttons. The specific LED light up whenever a button was activated and the LED was off when the button was deactivated. From this exercise also, I understood how to manage outputs (LEDs) on an Arduino with an input from outside the board (push buttons) which is one of the simplest concepts in the embedded systems. Also, I got to learn about pull down resistors as a solution to issues of floating inputs as well as the use of resistors to ensure that circuits are steady.

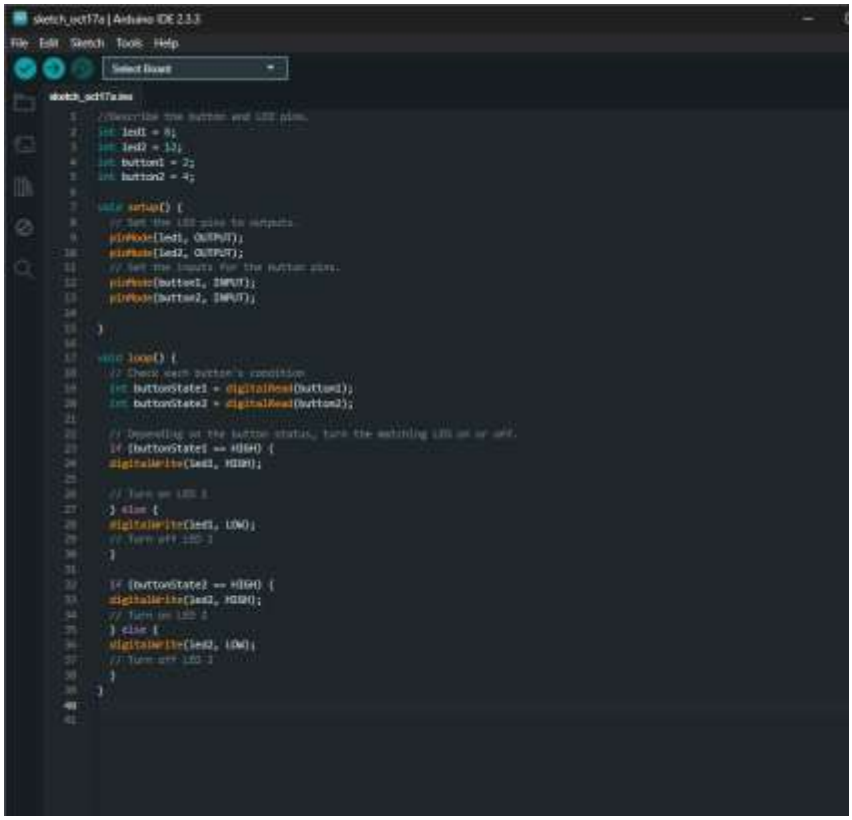
Reflection

- I was able to successfully build the circuit along with the uploading of the Arduino sketch as my accomplishment of the learning objectives. They flashed according to instructions when I pressed and released the button which in turn indicated that the circuit as well as the code in the microcontroller had functioned correctly.
- Amongst the most important things I learns was how the Arduing regulates outputs in actual time with buttons functioning as inputs. This is done to enable the required interactive embedded systems to be developed and forms the basis for the more complex structures.
- I knew what conditions and loops were and that they are basic for all kinds of programming languages. In using the Arduino kit I have gained more knowledge on how they operate and how it relates to an embedded system since it takes care of the hardware components such as the LEDs.
- This skill will be advantageous for other projects involving the use of sensors or human raw input for operation of equipment which include; Robotics, Home Automation or any IoT projects

Arduino Code

```
//Describe the button and LED pins.
int led1 = 8;
int led2 = 12;
int button1 = 2;
int button2 = 4;

void setup() {
  // Set the LED pins to outputs.
  pinMode(led1, OUTPUT);
  pinMode(led2, OUTPUT);
  // Set the inputs for the button pins.
  pinMode(button1, INPUT);
  pinMode(button2, INPUT);

}

void loop() {
  // Check each button's condition
  int buttonState1 = digitalRead(button1);
  int buttonState2 = digitalRead(button2);

  // Depending on the button status, turn the matching LED on or off.
  if (buttonState1 == HIGH) {
  digitalWrite(led1, HIGH);

  // Turn on LED 1
  } else {
```

```
  digitalWrite(led1, LOW);
  // Turn off LED 1
  }

  if (buttonState2 == HIGH) {
  digitalWrite(led2, HIGH);
  // Turn on LED 2
  } else {
  digitalWrite(led2, LOW);
  // Turn off LED 2
  }
}
```



Drive Link

https://drive.google.com/file/d/1F_5gw5SnCbXJkMPrj5DeEs1Ra2dVEjT2/view?usp=sharing

You Tube Link

https://youtu.be/m3g-UDYFK0I

3.4P - Arduino Control using Sensors

Summary

- Temperature and humidity measuring system for this assignment was developed using Arduino Uno and DHT22 sensor. The system is meant to read the moisture in the air and the temperature and display the readings on the serial monitor of the computer. I began by setting the circuit and ensured that the DHT22 sensor was well connected to the Arduino board, with the DATA pin connected to digital pin 2, VCC to 5V and GND to ground. To connect it to the sensor I uploaded the necessary DHT11 sensor library on the Arduino integrated development environment.

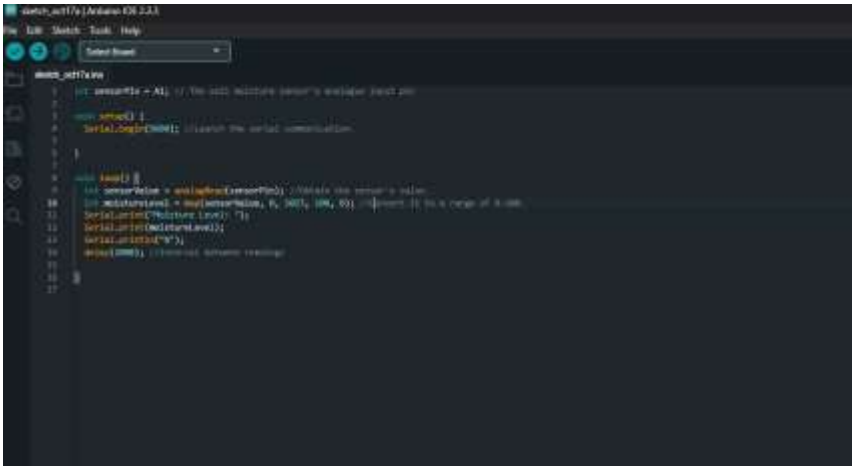
- Then came the writing of the code and uploading of the written code into the Arduino. It was designed to sample, at two seconds period, the temperature and humidity from the sensor and display it on the serial monitor. I ensured that the sensor provides valid information through using the system by checking on the values in different contexts after the upload or the sketch was complete. As for data, temperature and humidity data were presented in real time, as examples of digital sensors that can be used in measuring environmental data.

Reflection

- Firstly, it meant that due to the possibility of proper construction of the hardware, writing the necessary code and, finally, the receipt of real-time data from the DHT22 sensor, I can say that I met all the learning outcomes. The system worked smoothly and the Serial Monitor always displayed the identities of the temperature and humidity readings.
- The greatest thing which I realized in this assignment was how to access digital sensors of Arduino in order to collect and analyze environmental information. Since environmental parameters are generally captured through sensors, Das and Wong have identified that there is need to understand how sensors operate and how data from these sensors can be used. This is widely applied in smart homes, climate and weather tracking and, farming among other areas.
- While inherent to building my project, this particular challenge reintroduced me to Arduino programming and working with analog sensors, as well as introduced me to digital sensors as they require different approaches and coding methods. One new thing I learned from this task is libraries, especially the DHT sensor library which is an important aid for integrating sensors in Arduino project.
- This ability will be used in projects of environmental monitoring, for example , when creating a home automation system that is able change internal climate dependent on temperature and humidity level. Furthermore, it offers further advanced strategies in various areas including the IoT, using many sensors to capture real-time data and set off corresponding responses.

Arduino Code

```
int sensorPin = A1; // The soil moisture sensor's analogue input pin


void setup() {
  Serial.begin(9600); //Launch the serial communication.


}


void loop() {
  int sensorValue = analogRead(sensorPin); //Obtain the sensor's value.
  int moistureLevel = map(sensorValue, 0, 1023, 100, 0); //Convert it to a range of 0-100.
  Serial.print("Moisture Level: ");
  Serial.print(moistureLevel);
  Serial.println("%");
  delay(2000); //Interval between readings


}
```



Evidence of the Output

Drive Link

https://drive.google.com/file/d/1IX2grDQ2ds00k_zHw6ED7JFrXf1H8jF1/view?usp=sharing

You Tube Link

https://youtu.be/k4SR-IhbEm8

3.6P - Servo Motor Control with Arduino

Summary

- This way, I learned how to use an Arduino board to drive a servo motor during the performance of SIT111's Task 3.6P. The assignment needed papers read, a circuit to build, Arduino setting, and tests to conduct to see how good the motor was. It required some pins of the Arduino board to be connected to the power, ground and control terminal of the servo motor. With the Arduino IDE, I introduced movement to the motor; I commanded the motor to rotate to degrees like 45, 90 and 180; I was able to advance to more complex actions like commanding the motor to sweep from 0 to 180 degrees. I typed the control IC code with the help of Servo library and then uploaded the code and checked its behavior of the motor.

Reflection

- This is useful skills I learned in building circuits, creating and uploading code, and the use of certain commands to control movements of servo motor. This is useful outcomes that was learned on building circuits, creating and uploading code, and control of movements of servo motor using certain commands.

- The analysis indicated that PWM is significant in controlling servo motors in robotic systems and that hardware and software applications are interrelated.

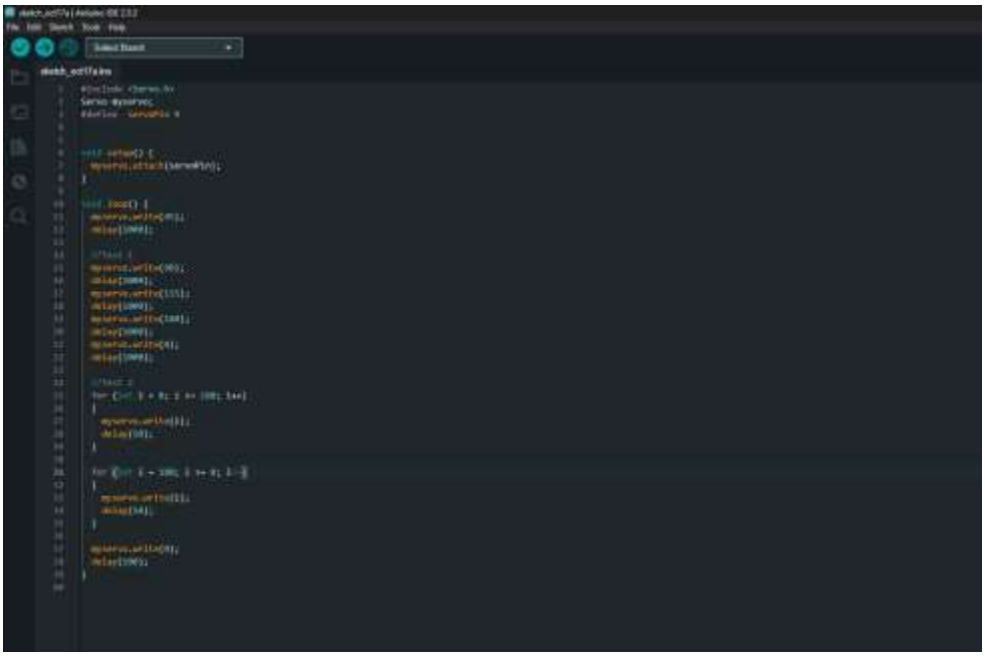
- The study clarified my knowledge on microcontrollers and programming in enhancing my application where it included the combination of automation concepts with the past electronics and programming courses.

- In a heavy motors and servos practical session, this exercise is to equip the students with some skills for the next line up of Robotics, Automation and Internet of Things projects. It will also prepare them for difficult tasks such as aerial surveillance by drone and controlling robotic arm.

Arduino Code

```
#include <Servo.h>
Servo myservo;
#define  servoPin 9

void setup() {
  myservo.attach(servoPin);
}

void loop() {
  myservo.write(45);
  delay(1000);

  //Test 1
  myservo.write(90);
  delay(1000);
  myservo.write(135);
  delay(1000);
  myservo.write(180);
  delay(1000);
  myservo.write(0);
  delay(1000);

  //Test 2
  for (int i = 0; i <= 180; i++)
  {
    myservo.write(i);
    delay(50);
```

```
  }
  for (int i = 180; i >= 0; i--)
  {
    myservo.write(i);
    delay(50);
  }

  myservo.write(0);
  delay(100);
}
```



Drive Link

https://drive.google.com/file/d/1BtPZmgxTJ0DNYVayn3GBi-ktGtTaJf-x/view?usp=sharing

You Tube Link

https://youtu.be/jRAxjCEIrZ4

SIT111 – Task 3.2C The ALU Truth Table

a.

OUT (111010)		X		Y
f (x, y) = -1	0001 (1)		0011 (3)	
set x to zero	0000			
don’t negate x	0000			
set y to zero			0000	
don’t negate y			0000	
add x and y	0000			
negate result	1111 (-1)			

Final output: - 1111 (-1)

b.

OUT (001101)		X		Y
f (x, y) =! x	1010 (-6)		0011 (3)	
set x to zero	1010			
negate x	1010			
set y to zero			0011	
negate y			0011	
add x and y				
negate result	0101			

Final output: - 0101 (5)

c.

OUT (011111)		X		Y
f (x, y) = x + 1	1011 (-5)		0001 (1)	
set x to zero	1011			
negate x	0100			
set y to zero			0000	
don’t negate y			0000	
add x and y	0100 + 1			
Don’t negate result	1100			

Final output – 1100 (-4)

d.

OUT (000010)		X		Y
f (x, y) = x + y	1011		0101	
set x to zero	1011			
don’t negate x	1011			
set y to zero			0101	
don’t negate y			0101	
add x and y	10000			
Don’t negate result	10000			

Final output - 10000 (16)

e.

OUT (000000)		X		Y
f (x, y) = x & y	1011		1001	
set x to zero	0000			
negate x	0000			
set y to zero			0000	
negate y			0000	
add x and y	0000			
Don’t negate result	0000			
X AND y	1001			

Final output – 1001 (-1)

Task6 3.2C Arduino Multi-LED Sequencer

Summary

- ✓ A circuit that utilizes resistors and digital pins was necessary for this project to bring light to eight LEDs. The Arduino IDE improved all aspects of bread boarding, fundamental electronics, and beginner programming by programming the LEDs. The possibility to manage digital outputs using easy code is important for detailed projects that involve sensors and actuators, as this experience pointed out.

Reflection

1. **How do you know you have achieved the learning goals?**

- ✓ In this circuit, the LEDs were flashed as required and I was able to fully grasp the concept of timing and control in the Arduino by increasing the delay time.

2. **What is the most important thing you learned from this and why?**

- ✓ The most important thing that was learned was the use of digital Write() for controlling pins and timing which is critical in any Arduino based project that requires time or input dependent output control.

3. **How does the content or skills learned here relate to things you already know?**

- ✓ This assignment helped me learn more about circuits and how they interact with programming to the extent that software can actively manipulate the hardware through LEDs.

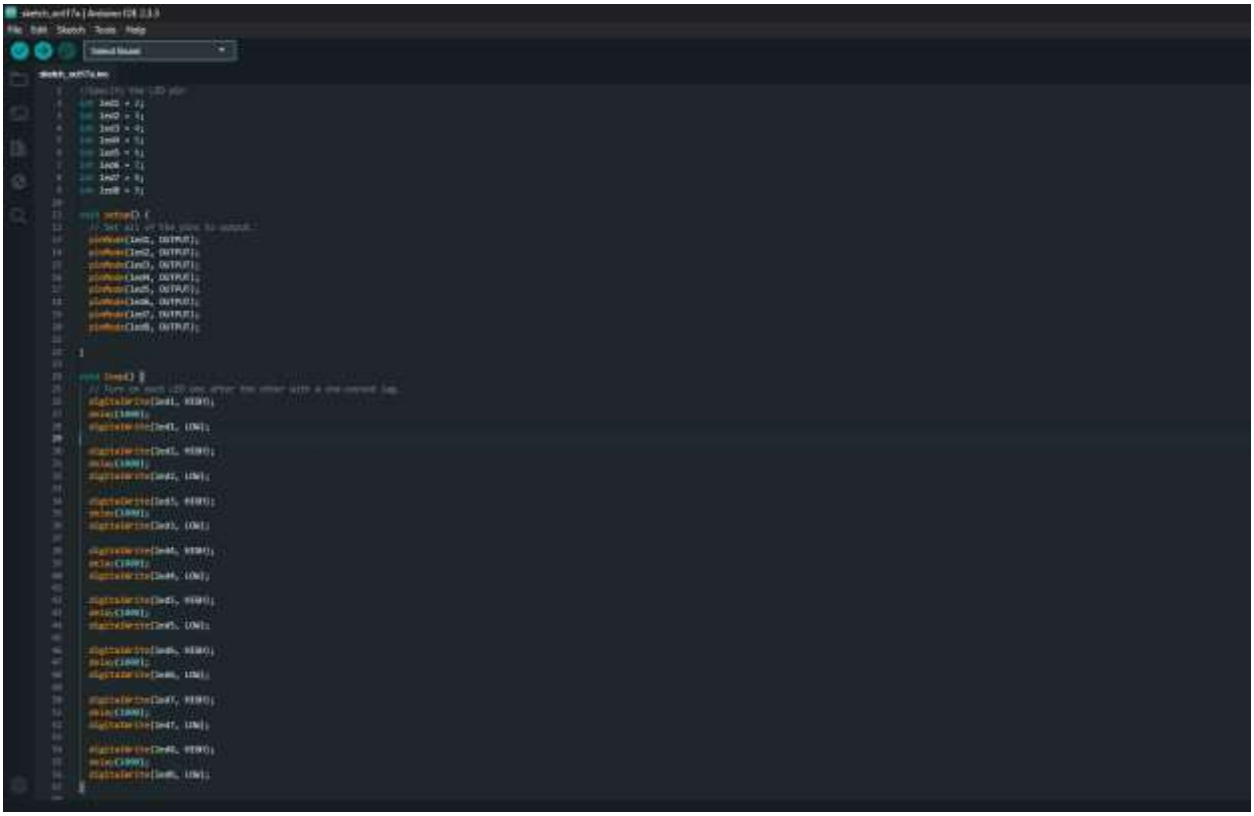
4. **Where or when do you think it will be useful?**

- ✓ This information is crucial for advanced microcontroller-based systems, automation, robotics, IoT projects, and complex device projects as it enhances the understanding of timing and control output.

Arduino Code

```
//Specify the LED pin
int led1 = 2;
int led2 = 3;
int led3 = 4;
int led4 = 5;
int led5 = 6;
int led6 = 7;
int led7 = 8;
int led8 = 9;

void setup() {
  // Set all of the pins to output.
  pinMode(led1, OUTPUT);
  pinMode(led2, OUTPUT);
  pinMode(led3, OUTPUT);
  pinMode(led4, OUTPUT);
  pinMode(led5, OUTPUT);
  pinMode(led6, OUTPUT);
  pinMode(led7, OUTPUT);
  pinMode(led8, OUTPUT);
}
void loop() {
  // Turn on each LED one after the other with a one-second lag.
  digitalWrite(led1, HIGH);
  delay(1000);
  digitalWrite(led1, LOW);
```

```
 digitalWrite(led2, HIGH);
 delay(1000);
 digitalWrite(led2, LOW);

 digitalWrite(led3, HIGH);
 delay(1000);
 digitalWrite(led3, LOW);

 digitalWrite(led4, HIGH);
 delay(1000);
 digitalWrite(led4, LOW);

 digitalWrite(led5, HIGH);
 delay(1000);
 digitalWrite(led5, LOW);

 digitalWrite(led6, HIGH);
 delay(1000);
 digitalWrite(led6, LOW);

 digitalWrite(led7, HIGH);
 delay(1000);
 digitalWrite(led7, LOW);

 digitalWrite(led8, HIGH);
 delay(1000);
 digitalWrite(led8, LOW);
}
```



Drive Link

https://drive.google.com/file/d/1qj5REYTLKJ2wTx919lPkiIjbk1RaQj3G/view?usp=sharing

You Tube Link
https://youtu.be/krCWaL-ykZM

3.5C - Integrated Environmental Monitoring

Summary

- For this particular assignment, I built and developed an Arduino-based environment monitoring system which is capable of measuring soil moisture, humidity and air temperature simultaneously. This I did by connecting a DHT22 sensor to measure the temperature and humidity and a Soil Moisture Sensor to track the moisture level in the soil. The environmental conditions were represented by two LED lights, red and green with which it was possible to determine whether they attained certain set values. The red LED only glows until the soil moisture and air temperature both cross certain levels, while the green LED is always on. After assembling the parts on the bread board using the jumper wires, I developed a software that made it possible to receive sensor data, process it and control the LEDs using the readings after integrating the parts with an Arduino Uno.

- While the soil moisture sensor provided an analog reading for dryness of the soil the DHT22 required a library to measure temperature and humidity. Using conditional logic as a means to set temperature and moisture standards resulted in the activation of the red LED when given threshold values reached. Since, I get to apply my circuit building capacity, integration of sensors, and coding skills with Arduino on the project. Also, it enhanced my understanding of environmental monitoring systems and how basic transmitting meters are utilized to gather data in live time.

Reflection

- In this project the learning objectives were accomplished due to the incorporation of several sensors into an Arduino circuit, displaying data in real time, and ensuring that LEDs worked according to specific thresholds.

- The first and most significant point learnt was that if the system is complex and required data from different sources then more than one sensor must be incorporated into the system and its outputs dealt with at the same time.

- By the exercise, I enhanced my understanding of managing analog and digital signals and working with individual sensors—two critical skills in complicated electronic projects.

- From this activity, people will receive information and skills that they can benefit from in other tasks such as Applications and Programing of Automated Systems for handling multiple data, Smart Agriculture and Environmental Analysis.

Arduino code

```
#include "DHT.h"
 #define DHTPIN 2 //The DHT22 digital pin
 #define DHTTYPE DHT22 //DHT 22 (AM2302)
 #define MOISTURE_PIN A0 //The soli moisture sensor's analogue pin
 #define GREEN_LED 9 //LED Green Pin
 #define RED_LED 10 //LED Red Pin

 DHT dht(DHTPIN, DHTTYPE);

void setup() {
  Serial.begin(9600);
  dht.begin();
  pinMode(GREEN_LED, OUTPUT);
  pinMode(RED_LED, OUTPUT);

}

void loop() {
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();
  int moistureLevel = analogRead(MOISTURE_PIN);

  if (isnan(humidity) || isnan(temperature)) {
    Serial.println("Failed to read from DHT sensor!");
    return;
  }
```

```
Serial.print("Humidity: ");
Serial.print(humidity);
Serial.print("%, Temp: ");
Serial.print(temperature);
Serial.print(" °C, Moisture: ");
Serial.print(moistureLevel);
Serial.print();

digitalwrite(GREEN_LED, HIGH); //Keep the green led going.

//Specify thresholds to activate the red LED.
if (temperature >30 && humidity <40 && moisturelevel <300) {
  digitalWrite(RED_LED, HIGH); //RED LED Turn on
} else {
  digitalWrite(RED_LED, LOW); // RED LED Turn off
}

delay(2000); //Manage your time between reading

}
```

Drive Link

https://drive.google.com/file/d/1oT_lVXrqrVOl7mpZspyrmQIkIKTXg84z/view?usp=sharing

You Tube Link

https://youtu.be/bhbkG_TnfRE