

Screenshots of Significant output

1. Start: When the program starts, all data will be obtained from a text file named data.txt and added to the blockchain, and then the program will automatically display the details on the screen and verify all existing blocks to check whether the chain is valid.

```
C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe

-----Display Section-----

Current Existing Blocks: 5

Displaying all blocks and Verifying the hash and chain...

-----Block Chain-----

||
||
|| Block no.: 1
|| Current Block Hash: 1182010322
|| Previous Block Hash: 1182010322
|| Next Block Hash: 1759189890
|| Timestamp: 20151225, 00:40:10
|| Completion Date: 20151109
|| Student ID: 12510
|| Student Name: Goh Jia Hui
|| Education Level: Form 4
|| Major: Science
|| Grades: 86%
||
|| VERIFIED! ||
||
|| Block no.: 2
|| Current Block Hash: 1759189890
|| Previous Block Hash: 1182010322
|| Next Block Hash: 569075163
|| Timestamp: 20171220, 00:01:11
|| Completion Date: 20171115
|| Student ID: 12510
|| Student Name: Goh Jia Hui
|| Education Level: Form 6
|| Major: Science
|| Grades: 80%
||
|| VERIFIED! ||
||
|| Block no.: 3
|| Current Block Hash: 569075163
|| Previous Block Hash: 1759189890
|| Next Block Hash: 979368683
|| Timestamp: 20200202, 23:40:09
|| Completion Date: 20200129
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 1 Semester 1
|| Major: BSc (Hons) Computer Science
|| Grades: 83%
||
|| VERIFIED! ||
||
|| Block no.: 4
|| Current Block Hash: 979368683
|| Previous Block Hash: 569075163
|| Next Block Hash: 340178578
|| Timestamp: 20200815, 23:16:11
|| Completion Date: 20200715
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 1 Semester 2
|| Major: BSc (Hons) Computer Science
|| Grades: 84%
||
|| VERIFIED! ||
||
|| Block no.: 5
|| Current Block Hash: 340178578
|| Previous Block Hash: 979368683
|| Next Block Hash: 340178578
|| Timestamp: 20210327, 00:27:13
|| Completion Date: 20210219
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 2 Semester 1
|| Major: BSc (Hons) Computer Science
|| Grades: 77%
||
|| VERIFIED! ||
||
-----End of the Block Chain-----

Verified Successfully! The chain is EXIST and VALID! WOOHOO~
The FIRST block of the chain is Block 1 and the LAST block of the chain is Block 5.

-----MENU-----
```

2. Menu: After displaying the existing blocks and the chain, program will show a menu for user to choose what to do next.

- a) If user entered an invalid value, it would inform user and let user enters again.

```
"C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe"
|| Completion Date: 20210219
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 2 Semester 1
|| Major: BSc (Hons) Computer Science
|| Grades: 77%
=====
VERIFIED!
||
||
-----End of the Block Chain-----
Verified Successfully! The chain is EXIST and VALID! WOOHOO~
The FIRST block of the chain is Block 1 and the LAST block of the chain is Block 5.

-----MENU-----
Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 6

Hey! Bad Choice! Choose again please~

-----MENU-----
Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 1

Adding Block 6...

Please enter the information below:
Completion date(YYYYMMDD): aa

Integer only---
Completion date(YYYYMMDD): 20121225
Student ID: 12510
Student Name: Jia Hui
Educational Level: Form 1
```

3. Add block: If user choose to add block, the program will detect which block is going to add and let user enters the information.
- a) If user entered invalid value, the program would inform user and let user to enter again.
- b) After user finished entering, the program will display the added block with the details. Menu will show up to user again to choose what to do next again.

```
"C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe"

Hey! Bad Choice! Choose again please~

-----MENU-----
Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 1

Adding Block 6...

Please enter the information below:
Completion date(YYYYMMDD): aa

Integer only---
Completion date(YYYYMMDD): 20121225
Student ID: 12510
Student Name: Jia Hui
Educational Level: Form 1
Major: Art
Grades: 89%

Added Block 6 Successfully!

Below is the block you just added. Satisfied? Yes? Good! No? Go, go, go modify~
=====
|| Block no.: 6
|| Current Block Hash: 1491142372
|| Previous Block Hash: 340178578
|| Next Block Hash: 1491142372
|| Timestamp: 20210326, 14:31:50
|| Completion Date: 20121225
|| Student ID: 12510
|| Student Name: Jia Hui
|| Education Level: Form 1
|| Major: Art
|| Grades: 89%
=====

Remember to verify the chain by choosing 4 in the menu section :D

-----MENU-----
Do you want to ...
```

4. Modify block: If user choose to modify block, the program will allow user to enter the block number to be modified.
- If the block user entered does not exist or invalid, program will inform user and let user enter again.
 - After entered the existing block number, program will display the current information of the block and let user enters the new information.
 - When user finished entering the new data, program will automatically display the new details of the block and menu will also show up for user again. The hash of the block will get regenerated if the new data is entered and the program will update other affected blocks also.

```
"C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe"

Remember to verify the chain by choosing 4 in the menu section :D

-----MENU-----

Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 2

-----
Which block would you like to modify?
Block: 7

Modified Block 7 Unsuccessfully! Due to block does NOT exist. Aiyo, Look carefully for the block number la..
Block: 5

Modifying block 5...

Below is the current information of Block 5
=====
|| Block no.: 5
|| Current Block Hash: 340178578
|| Previous Block Hash: 979368683
|| Next Block Hash: 1491142372
|| Timestamp: 20210327, 00:27:13
|| Completion Date: 20210219
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 2 Semester 1
|| Major: BSc (Hons) Computer Science
|| Grades: 77%
=====

Please enter the new data...
Completion date(YYYYMMDD): 20210303
Student ID: 20105227
Student Name: Goh Jia Hui
Educational Level: Year 2 Semester 1
Major: Art
Grades: 87%

Modified Block 5 Successfully!

Below is the new information of Block 5
=====
|| Block no.: 5
|| Current Block Hash: 1255814340
|| Previous Block Hash: 979368683
|| Next Block Hash: 1491142372
|| Timestamp: 20210326, 14:33:51
|| Completion Date: 20210303
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 2 Semester 1
|| Major: Art
|| Grades: 87%
=====

It is important to always verify the chain- you can choose the function in the menu section-

-----MENU-----

Do you want to ...
```

4a

4b

4

4c

5. Delete block: If user choose to delete block, the program will allow user to enter the block number to be deleted.
- If the block user entered does not exist or invalid, program will inform user and let user enter again.
 - After entered the existing block number, program will display the information of the block and inform user that this block is deleted from the chain. Inside the system, it will automatically re-join and update the blockchain after a block is deleted. Menu will also show up for user again after the deletion.

```
"C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe"
[| Education Level: Year 2 Semester 1
[| Major: Art
[| Grades: 87%
=====
It is important to always verify the chain- you can choose the function in the menu section-
-MENU-
Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 3
=====
Which block would you like to delete?
Block: 9
Deleted Block 9 Unsuccessfully! The block you selected does NOT exist, how am I supposed to delete? Enter again..
Block: 3
Deleting block 3...
Below is the information of Block 3
=====
[| Block no.: 3
[| Current Block Hash: 569075163
[| Previous Block Hash: 1759189890
[| Next Block Hash: 979368683
[| Timestamp: 20200202, 23:40:09
[| Completion Date: 20200129
[| Student ID: 20105227
[| Student Name: Goh Jia Hui
[| Education Level: Year 1 Semester 1
[| Major: BSc (Hons) Computer Science
[| Grades: 83%
=====
Deleted Block 3 Successfully!
It will be a good choice to verify the chain now- There is a verify function in the menu section-
-MENU-
Do you want to ...
1. Add block
2. Modify block
3. Delete block
```

5a

5b

5

6. Display and Verify: If user choose display and verify in the menu, it will first show how many blocks are available and then display the latest block chain with the details of all blocks. It will also verify the hash every time it shows a block. When successfully verified all blocks, it will inform user the chain is valid and which block is the first and last block.
- New added block (See Details in 3. Add Block)
 - Modified block (See Details in 4. Modify Block)
 - Block 3 is deleted, Block 2 and Block 4 are connected and the whole blockchain is re-joined. (See Details in 5. Delete Block)

```

C:\Users\Jia Hui\Desktop\20105227_GohJiaHui_CW2\20105227_GohJiaHui_CW2.exe
It will be a good choice to verify the chain now~ There is a verify function in the menu section~

-----MENU-----
Do you want to ...
1. Add block
2. Modify block
3. Delete block
4. Display and Verify
5. Quit
Choice: 4

-----Display Section-----

Current Existing Blocks: 5
Displaying all blocks and Verifying the hash and chain...

-----Block Chain-----
||
=====
|| Block no.: 1
|| Current Block Hash: 1182010322
|| Previous Block Hash: 1182010322
|| Next Block Hash: 1759189890
|| Timestamp: 20151225, 00:40:10
|| Completion Date: 20151109
|| Student ID: 12510
|| Student Name: Goh Jia Hui
|| Education Level: Form 4
|| Major: Science
|| Grades: 86%
=====
|| VERIFIED! ||
=====
|| Block no.: 2
|| Current Block Hash: 1759189890
|| Previous Block Hash: 1182010322
|| Next Block Hash: 979368683
|| Timestamp: 20171220, 00:01:11
|| Completion Date: 20171115
|| Student ID: 12510
|| Student Name: Goh Jia Hui
|| Education Level: Form 6
|| Major: Science
|| Grades: 88%
=====
|| VERIFIED! ||
=====
|| Block no.: 3
|| Current Block Hash: 979368683
|| Previous Block Hash: 1759189890
|| Next Block Hash: 1255814340
|| Timestamp: 20200315, 23:16:11
|| Completion Date: 20200715
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 1 Semester 2
|| Major: BSc (Hons) Computer Science
|| Grades: 84%
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|| VERIFIED! ||
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|| Block no.: 4
|| Current Block Hash: 1255814340
|| Previous Block Hash: 979368683
|| Next Block Hash: 1491142372
|| Timestamp: 20210326, 14:33:51
|| Completion Date: 20210303
|| Student ID: 20105227
|| Student Name: Goh Jia Hui
|| Education Level: Year 2 Semester 1
|| Major: Art
|| Grades: 87%
=====
|| VERIFIED! ||
=====
|| Block no.: 5
|| Current Block Hash: 1491142372
|| Previous Block Hash: 1255814340
|| Next Block Hash: 1491142372
|| Timestamp: 20210326, 14:31:50
|| Completion Date: 20212225
|| Student ID: 12510
|| Student Name: Jia Hui
|| Education Level: Form 1
|| Major: Art
|| Grades: 89%
=====
|| VERIFIED! ||
=====
-----End of the Block Chain-----

Verified Successfully! The chain is EXIST and VALID! WOOHOO~
The FIRST block of the chain is Block 1 and the LAST block of the chain is Block 6.

```

7. Quit: User can choose to exit the program anytime the menu shows up.
8. Running time of the program: The program will continue to display the menu to the user, so if the user does not choose to exit the program, the execution time will continue running.

```
"C:\Users\Jia Hui\Desktop\20105227_GohlaHui_CW2\20105227_GohlaHui_CW2.exe"

||
=====
|| Block no.: 6
|| Current Block Hash: 1491142372
|| Previous Block Hash: 1255814240
|| Next Block Hash: 1491142372
|| Timestamp: 20210326, 14:31:50
|| Completion Date: 20121225
|| Student ID: 12510
|| Student Name: Jia Hui
|| Education Level: form 1
|| Major: Art
|| Grades: 89%
=====
VERIFIED!
||
||
-----End of the Block Chain-----

Verified Successfully! The chain is EXIST and VALID! WOOHOO~
The FIRST block of the chain is Block 1 and the LAST block of the chain is Block 6.

-----MENU-----
Do you want to ...
1. Add Block
2. Modify Block
3. Delete block
4. Display and Verify
5. Quit
Choice: 5

Bye, hooman~

Process returned 0 (0x0)   execution time : 240.488 s
Press any key to continue.
```