# CSC 2111 – Class Exercise 1 Answer
# Unit 3 – The Instruction Cycle

Given the following abstract computer:

**Operation Codes**

```
5 - Subtract memory from AC
1 - Load AC from memory
7 - Halt
3 - Add to AC from memory
6 - Load AC from memory
2 - Store AC to memory
4 - Store AC to memory
0 - Store AC to memory; if memory > 0 PC = PC - 7
```

| | Memory |
|---|---|
| 200 | 6600 |
| 201 | 5601 |
| 202 | 4602 |
| 203 | 6600 |
| 204 | 3602 |
| 205 | 2603 |
| 206 | 1602 |
| 207 | 0600 |
| 208 | 7000 |
| ..... | |
| 600 | 4 |
| 601 | 1 |
| 602 | |
| 603 | |

| |
|---|
| PC: 200 |
| AC: |
| IR: |

- Manually perform the fetch-execute cycle to run the program already loaded into main memory.
- Use the format below to keep track of the state of the registers while the program is running (Step 1 serves as an example), add as many **steps** as is necessary to complete the program.
- Indicate the data values in memory at the end of program execution.

| | **Fetch** | **Execute** |
|---|---|---|
| **Step 1** | PC: 200<br>AC:----<br>IR: | PC:<br>AC:<br>IR: |

| | **Fetch** | **Execute** |
|---|---|---|
| **Step 1** | PC: 200 | PC: 201 |
| | AC:---- | AC: 4 |
| | **IR: 6600** | **IR: 6600** |
| **Step 2** | **PC: 201** | **PC: 202** |
| | **AC:4** | **AC: 3** |
| | **IR: 5601** | **IR: 5601** |
| **Step 3** | PC: 202 | PC: 203 |
| | AC: 3 | AC: ---- |
| | **IR: 4602** | **IR: 4602** |
| **Step 4** | PC: 203 | PC: 204 |
| | AC: ---- | AC: 4 |
| | **IR: 6600** | **IR: 6600** |
| **Step 5** | PC: 204 | PC: 205 |
| | AC: 4 | AC: 7 |
| | **IR: 3602** | **IR: 3602** |
| **Step 6** | PC: 205 | PC: 206 |
| | AC: 7 | AC: ---- |
| | **IR: 2603** | **IR: 2603** |
| **Step 7** | PC: 206 | PC: 207 |
| | AC: --- | AC: 3 |
| | **IR: 1602** | **IR: 1602** |
| **Step 8** | PC: 207 | PC: 200 |
| | AC: 3 | AC: --- |
| | **IR: 0600** | **IR: 0600** |
| **Step 9** | PC: 200 | PC: 201 |
| | AC:---- | AC: 3 |
| | **IR: 6600** | **IR: 6600** |
| **Step 10** | PC: 201 | PC: 202 |
| | AC:3 | AC: 2 |
| | IR: 5601 | IR: 5601 |

| | | |
|---|---|---|
| **Step 11** | PC: 202 | PC: 203 |
| | AC: 2 | AC: ---- |
| | **IR: 4602** | **IR: 4602** |
| **Step 12** | PC: 203 | PC: 204 |
| | AC: ---- | AC: 3 |
| | **IR: 6600** | **IR: 6600** |
| **Step 13** | PC: 204 | PC: 205 |
| | AC: 3 | AC: 5 |
| | **IR: 3602** | **IR: 3602** |
| **Step 14** | PC: 205 | PC: 206 |
| | AC: 5 | AC: ---- |
| | **IR: 2603** | **IR: 2603** |
| **Step 15** | PC: 206 | PC: 207 |
| | AC: --- | AC: 2 |
| | **IR: 1602** | **IR: 1602** |
| **Step 16** | PC: 207 | PC: 200 |
| | AC: 2 | AC: --- |
| | **IR: 0600** | **IR: 0600** |
| **Step 17** | PC: 200 | PC: 201 |
| | AC:---- | AC: 2 |
| | **IR: 6600** | **IR: 6600** |
| **Step 18** | PC: 201 | PC: 202 |
| | AC:2 | AC: 1 |
| | IR: 5601 | IR: 5601 |
| **Step 19** | PC: 202 | PC: 203 |
| | AC: 1 | AC: ---- |
| | **IR: 4602** | **IR: 4602** |
| **Step 20** | PC: 203 | PC: 204 |
| | AC: ---- | AC: 2 |
| | **IR: 6600** | **IR: 6600** |
| **Step 21** | PC: 204 | PC: 205 |
| | AC: 2 | AC: 3 |
| | **IR: 3602** | **IR: 3602** |
| **Step 22** | PC: 205 | PC: 206 |

| | | |
|---|---|---|
| | AC: 3 | AC: ---- |
| | **IR: 2603** | **IR: 2603** |
| 23 | PC: 206 | PC: 207 |
| | AC: --- | AC: 1 |
| | **IR: 1602** | **IR: 1602** |
| 24 | PC: 207 | PC: 200 |
| | AC: 1 | AC: --- |
| | **IR: 0600** | **IR: 0600** |
| 25 | PC: 200 | PC: 201 |
| | AC:---- | AC: 1 |
| | **IR: 6600** | **IR: 6600** |
| 26 | PC: 201 | PC: 202 |
| | AC:1 | AC: 0 |
| | IR: 5601 | IR: 5601 |
| 27 | PC: 202 | PC: 203 |
| | AC: 0 | AC: ---- |
| | **IR: 4602** | **IR: 4602** |
| 28 | PC: 203 | PC: 204 |
| | AC: ---- | AC: 1 |
| | **IR: 6600** | **IR: 6600** |
| 29 | PC: 204 | PC: 205 |
| | AC: 1 | AC: 1 |
| | **IR: 3602** | **IR: 3602** |
| 30 | PC: 205 | PC: 206 |
| | AC: 1 | AC: ---- |
| | **IR: 2603** | **IR: 2603** |
| 31 | PC: 206 | PC: 207 |
| | AC: --- | AC: 0 |
| | **IR: 1602** | **IR: 1602** |
| 32 | PC: 207 | PC: 208 |
| | AC: 0 | AC: --- |
| | **IR: 0600** | **IR: 0600** |
| 33 | PC: 208 | -- |
| | AC: --- | -- |

| | | |
|---|---|---|
| | **IR: 7000** | **---** |