

Workshop SAM-4

This worksheet is aimed at the second part of Assessment 3 where you will produce a 10-minute voice-recorded explanation of the Fetch-Execute cycle. There are two activities which you will explain in your voice-recording. Guidance about the recording process is provided at the end of this sheet.

Downloads:

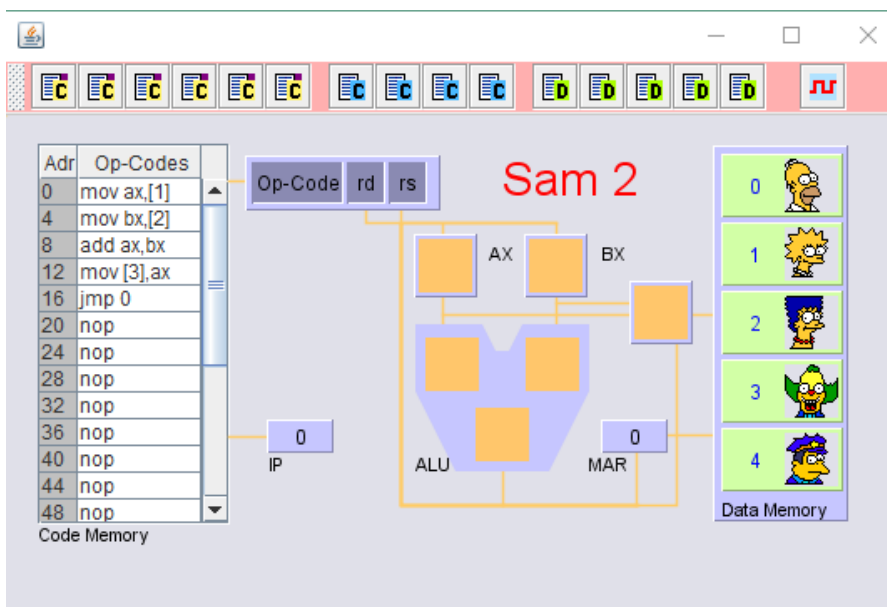
(a) You may need to install the Java Runtime Environment (JRE) which you can find here: <https://www.java.com/en/download/manual.jsp>

(b) Download the simulator Sam4AL from the module web page **Workshops_Sem2** located at **Workshop 6 SAM-4 Simulator Download**. Unzip the folder to a place of your choice.


Activities


1 Getting to know SAM-4

(a) Double left-click on **RUN_ME.bat** and the following app will open up.



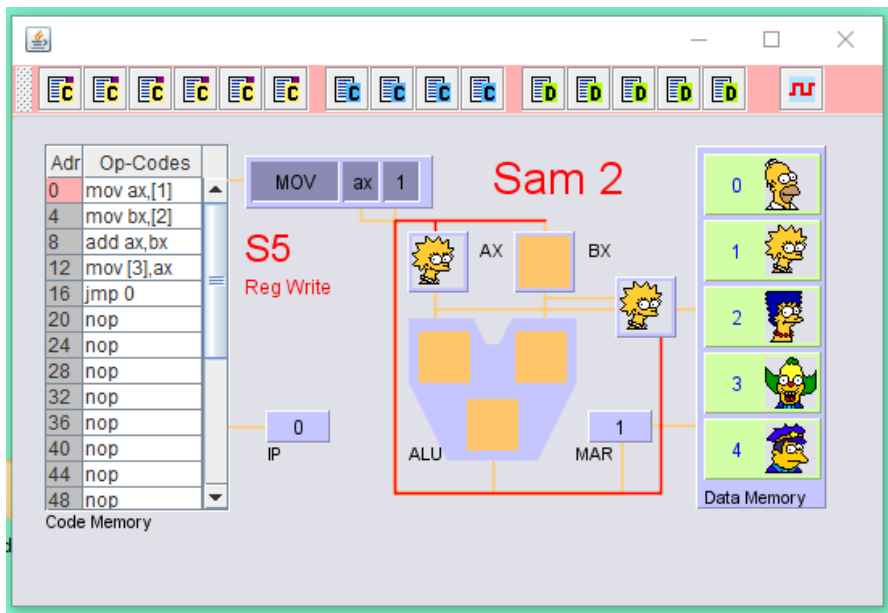
(b) Click on the icons labelled D to load different data into **Data Memory**.

(c) Click a few times on the clock icon  to step through the five stages of the fetch-execute cycle.

(d) Finally close down the app 

2 The instruction `mov ax,[1]`


This moves the contents of memory location 1 into register ax. So when the 5 stages of the Fetch-Execute cycle are complete, then SAM will look like this



Here are the 5 stages of the complete Fetch-Execute cycle

Stage 1 Instruction Fetch	The instruction is moved from code memory to the instruction register
Stage 2 Decode, Register Read	The instruction is converted to electronic signals. If a register needs to be read (to put its contents into the ALU) this happens now
Stage 3 ALU operations	Any addition, subtraction etc is performed here
Stage 4 Memory Access	Any read or write to memory is performed
Stage 5 Register Write	Any write to a register is performed

(a) Start SAM and make sure the instruction at address 0 is highlighted in pink as above. Hit the

clock  once to get SAM into state S1. Take a snip of S1 and paste into a word document

(b) Hit the clock again to get into S2. Take a snip of S2 and paste it into your document

(c) Continue until you have all five stages S1 ... S5.

(d) Look at all 5 stages together and try to understand (i) How the address **1** propagates through the CPU and (ii) how the contents of memory at address **1** gets into register **ax**.

(e) Now press the clock again and cycle through the 5 stages of the instruction `mov bx,[2]` You do not need to snip these stages.

3 The instruction `add ax,bx`

This instruction adds the contents of registers `ax` and `bx` and writes the result back into `ax`.

(a) Run through the 5 stages of the FE cycle for this instruction and snip each stage so you have all 5 stages on a single sheet

(b) Make sure you understand (i) How the contents of `ax` and `bx` get into the **ALU** (ii) How the added data gets back into register `ax`

Guidance for your Voice Recording

1. This should be around 10 mins, but the exact time is not important.
2. Explain what is happening in the 5 stages of the `mov ax,[1]` instruction in as much detail as you can. You may assume that I have a sheet with the 5 stages in front of me.
3. Explain what is happening in the 5 stages of the `add ax,bx` instruction in as much detail as you can. You may assume that I have a sheet with the 5 stages in front of me.