CPU Structure Homework

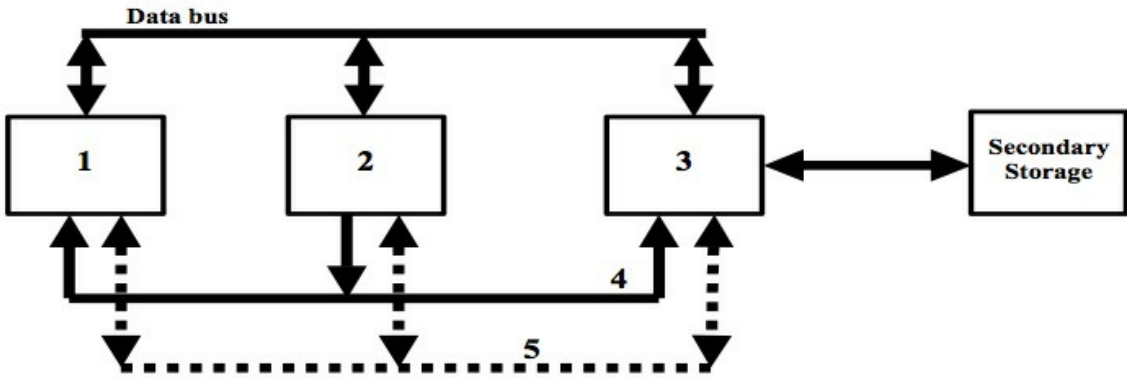
You should refer to the **homework policy** for details on how this homework should be submitted.

Attempt all questions and show all working.

Question 1

Some of the components of a computer system are:

- processor
- main memory
- address bus
- data bus
- control bus
- I/O port
- secondary storage



The diagram above shows how these components are connected.

1. Using the list of components above name each of the following:

```
1\. Disk I/O controller
2\. Processor
3\. Memory
4\. Address Bus
```

```
5\. Control Bus

(**5 marks**)
```

Question 2

What is the function of the following components:

1. **processor**: It is responsible for executing operations and arithmetic and supervising the functioning of the other oarts of the system.
2. **main memory**: Main memory is the part that stores all the information of of programs and data currently being used. This is volatile storage so only remembers things when a power supply or electric current is passing through it.
3. **secondary storage**: This is where programs that are not in use are stored, it is non-volatile storage so will remember data when not powered.

(**3 marks**)

Question 3

Give **two** examples of a signal carried by the control bus.

1. *Clock signal*
2. *Command signal*

(**2 marks**)

Question 4

Apart from data, what else is carried on the data bus?
Instructions which are to be executed.

(**1 mark**)

Question 5

A single accumulator microprocessor supports the assembly language instructions:

```
LOAD memory reference
ADD memory reference
STORE memory reference
```

An example instruction is:

```
LOAD 4
```

This instruction would copy the contents of the referenced memory location **4** into the accumulator register.

1. Identify which part of the instruction is the ***operand*** and which part is the ***opcode*** by writing the words in the two table below.

```
|LOAD|4|
|----|-|
| *opcode* | *operand* |

(**1 mark**)
```

2. The accumulator is a general purpose register. Define the term register? (**1 mark**)
A very fast memory location inside the processor or I/O input

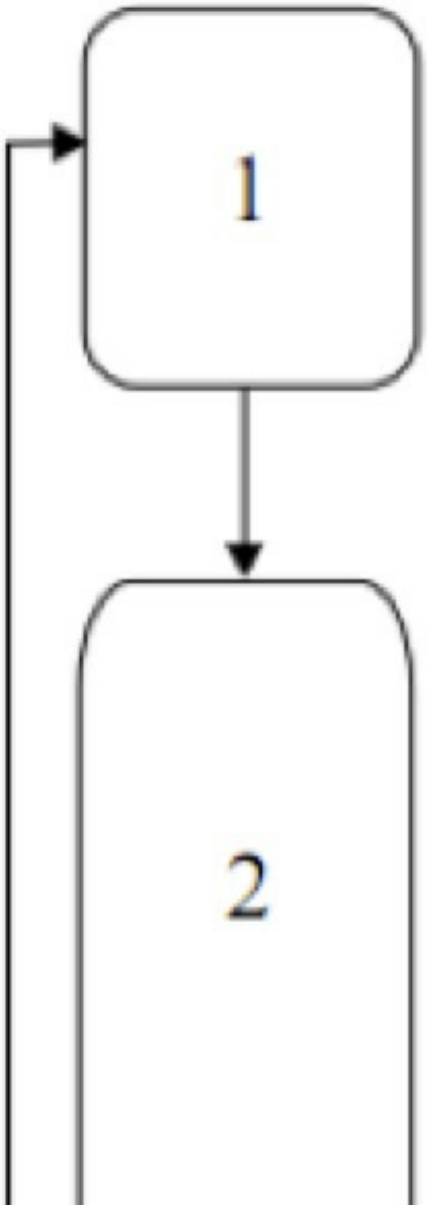
3. Using the given assembly language instructions, write an assembly language program that adds together the values stored in memory locations 12 and 13, storing the resulting total in memory location 14. (**3 marks**)

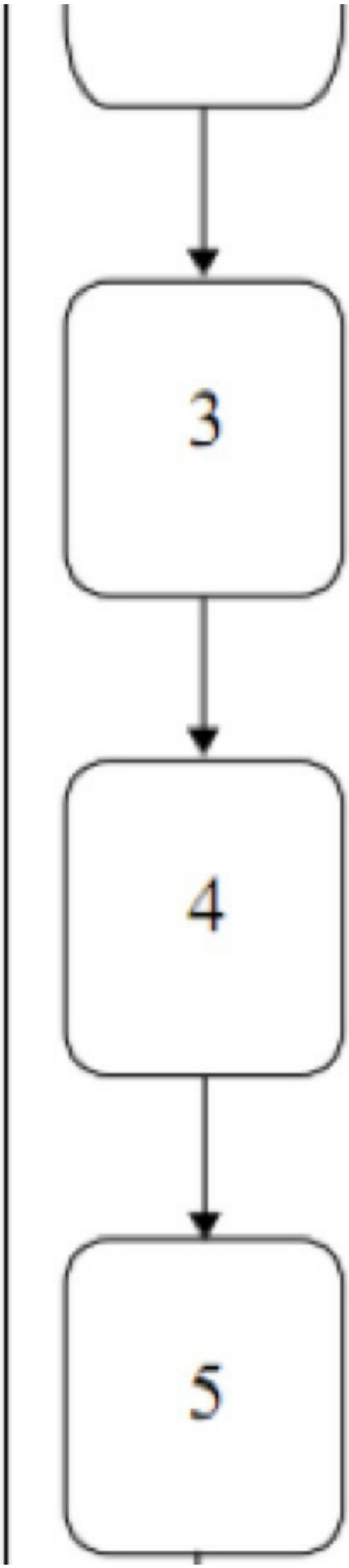
opcode	operand
LOAD	12

opcode	operand
ADD	13
STO	14

Question 6

The diagram below shows the fetch-execute cycle. Some of the steps have been described.




3
4
5

Describe the missing steps, using either register transfer notation of a written description. Steps 2 and 3 occur at the same time.

1. *MAR <– [PC]*
2. `PC ← [PC] + 1` or *increment contents of program counter register*
3. *MBR <– [Memory]*
4. `CIR ← [MBR]` or *transfer contents of memory buffer register to current instruction register*
5. *Interrupts are processed if there are any*
6. `[CIR] decode and execute` or *execute instruction in current instruction register*

(**3 marks**)

Question 7

What would the effect on the performance of the computer system of increasing the

1. width of the data bus?
Increases the overall performance of the computer because more data is transferred per operation.
2. width of the address bus?
This would increase the overall memory capacity of the system
3. clock speed?
Increases the speed of operations.

(**3 marks**)

Total 22 marks