Solutions

Chapter 3: Understanding how computers work

Activity: Seeing the cycle in action!, pages 24–25

Table 3.3

CPU component	Clock cycle:	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4
	Clock step:	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4
	Cycle phase	fetch																				
COUNT	counter	1	2	3	4			1	2	3	4	5	6	1	2	3	4	5	1	2	3	4
IR	Instruction register	ADD 0	LOD-C 3	LOD-C 3	LOD-C 3			LOD-C 3	ADD-C 4	ADD-C 4	ADD-C 4	ADD-C 4	ADD-C 4	ADD-C 4	STO 10	STO 10	STO 10	STO 10	STO 10	HLT	HLT	HLT
PC	Program counter	0	0	1	1			1	2	2	2	2	2	2	3	3	3	3	3	3	4	4
ADDR	Current address	0	0	0	0			1	1	1	1	1	1	2	2	2	10	10	3	3	3	3
X	X register	0	0	0	0			0	0	0	3	3	3	3	3	3	3	3	3	3	3	3
Y	Y register	0	0	0	0			0	0	0	4	4	4	4	4	4	4	4	4	4	4	4
AC	Accumulator	0	0	0	3			3	3	3	3	7	7	7	7	7	7	7	7	7	7	7

Review, pages 27–8

Identify

1 Fetch-execute cycle, machine cycle or instruction cycle

2 CPU carries out the instructions of a computer program by performing the basic arithmetic, logical, control and input/output (I/O) operations specified by the instructions.

3 **a** The control decodes the program instructions and selects arithmetic and logic operations.
b Integrated circuit(s) comprising volatile primary working memory of a computer.
c The address register holds the address of a block of memory.
d Register that holds the address of the instruction to be executed next.
e Register that holds the address of the current instruction being executed.
f The ALU performs mathematical and logical operations on data.
g Register that stores the results of ALU calculations.

4 Code written in higher level human-readable programming languages usually using ordinary text.

5 A mnemonic-based language of abbreviations for assembly instructions forming a convenient one-to-one representation for the binary machine language.

Analyse

6 In indirect addressing the operand refers to a memory location, whereas in direct addressing it refers to a data value.

7 Fetch: read an instruction stored in memory (RAM)
Decode: translate the instruction
Execute: perform the instruction
Store: write the result to memory (RAM)

Research

8 Responses could consider:
- the amount of RAM memory
- the speed and generation of your CPU (the system clock)
- the size of the registers (word size) on the CPU
- the bus type and speed
- input and output devices
- the amount of cache memory.

9 Students' responses will vary.