# Worksheet 3 The processor instruction set

# Task 1

1. Some of the instructions available for an imaginary processor are shown below:

|  |  |  |
| --- | --- | --- |
| **opcode** | **Instruction** | **Description** |
| 0010 01 | LOAD | Load from memory |
| 0011 01 | STORE | Write to memory |
| 0100 00 | ADD | Add value to register contents |
| 0101 00 | SUB | Subtract value from register contents |
| 0110 00 | LSHIFT | Left bit shift value |
| 0111 00 | RSHIFT | Right bit shift value |

1. What is the term used for the complete collection of all the commands in machine code that can be recognised and executed by a processor? [1]

1. What might the two right hand bits of the opcode represent in the instructions above? [2]
2. Explain what may change if a different make of processor is used. [2]
3. A processor uses four bits per instruction. Calculate how many possible instructions can be encoded. [1]
4. Describe why a program compiled on a computer with a certain type of processor cannot run on a different computer with a different make of processor. Write your answer with reference to machine code and instruction sets. [4]

# Task 2

1. Processor instructions are made up of three components.
2. State each component and describe what these three components are for: [6]
3. A processor uses 16 bit instructions. Assuming two bits for the addressing mode, complete the table below to summarise the number of instructions and the maximum value of the operand if different instruction structures are used: [13]

|  |  |  |  |
| --- | --- | --- | --- |
| **Bits used for opcode** | **Number of possible operations** | **Bits used for operand** | **Maximum value available for operand** |
| 2 | 4 | 12 |  |
|  |  | 10 |  |
| 5 | 32 | 9 | 511 |
|  | 64 |  |  |
| 7 | 128 | 7 | 127 |
| 10 |  |  |  |
|  |  |  | 3 |

1. Compare direct and immediate modes of addressing. [2]