**Question 1:** An XYZ computer’s instruction set (the number of instructions it can perform) is given below. Each instruction takes 4 bytes (one word) in the memory. Integer takes two bytes in memory. Character takes 1 byte in memory. The initial contents on the memory, state of CPU (PC register value) and a simple program is given below. Run the program (one instruction at a time in the sequence according to fetch and execute cycle).

|  |  |
| --- | --- |
| Program: | Character / Data Shown on screen (Show decimal values in case of integers, and show actual alphabets incase of character data) |
| ADD 110 95 40 | NA |
| SHOW INT 110 |  |
| SUB 116 110 40 | NA |
| SHOW INT 116 |  |
| SHOW CHAR 130 |  |
| SHOW CHAR 131 |  |
| SHOW CHAR 132 |  |
| SHOW CHAR 133 |  |
| SHOW CHAR 134 |  |

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| PC (Program Counter Register) : 10 |

Memory:

|  |  |
| --- | --- |
| Location | Contents |
| 10 | 00000001 |
| 11 | 01101110 |
| 12 | 01011111 |
| 13 | 00101000 |
| 14 |  |
| 15 |  |
| 16 |  |
| 17 |  |
| …… |  |
| 40 | 00000000 |
| 41 | 00110010 |
| … |  |
| 95 | 00000000 |
| 96 | 00110111 |
| …. |  |
| 110 | 01010100 |
| 111 | 00001111 |
| 112 | 01010010 |
| 113 | 00010101 |
| 114 | 00101010 |
| 115 | 00010101 |
| 116 | 00001001 |
| 117 | 00010101 |
| …. |  |
| 130 | 01001000 |
| 131 | 01000101 |
| 132 | 01001100 |
| 133 | 01001100 |
| 134 | 01001111 |
| ….. |  |

|  |  |  |
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| Instruction | Binary Code | Description |
| ADD Dest OP1 OP2  Example: ADD 110 95 40 | INS CODE DEST LOC OP1 LOC OP2 LOC  00000001 01101110 01011111 00101000 | Adds the values present at memory locations 95, 40 and stores it at location 110 |
| SUBTRACT Dest Op1 OP2  Example: SUB 116 110 40 | INS CODE DEST LOC OP1 LOC OP2 LOC  00000010 01110100 01101110 00101000 | Subtracts the value present at 40 from value present at 110 and stores it at location 116 |
| SHOW INT  Example: SHOW INT 116 | INS CODE -------------OP LOC-----------------  00000100 00000000 00000000 01110100 | Reads an integer of two bytes from location 116 and shows it on screen |
| SHOW CHAR  Example: SHOW 130 | INS CODE -------------OP LOC-----------------  00001000 00000000 00000000 10000010 | Reads an alphabet of one byte from location 130 and shows it on screen |

**Question 2:** After the execution of the given program, give the address of those memory locations whose value will be changed. Also write the values.