1. A burglar alarm runs on a processor with the Little Man Computer (LMC) instruction set.
    a. One of the instructions in the set is Branch If Positive (BRP). Describe what the instruction BRP does.

[2]

A numeric PIN code entered in to the burglar alarm is compared with the code stored at the memory location *passcode*.

If the codes match, the program jumps to the part of the program labelled *deactivate*.

If the codes do not match, the program jumps to the part of the program labelled *alarm*.

    b. Write the LMC code to meet the requirements above. (You don't have to write the code for labels *deactivate* and *alarm*, as you can assume this has already been written elsewhere)

[4]

2. An example of a register in the Von Neumann Architecture is the Accumulator (ACC).

   Give a Little Man Computer instruction that will copy the contents of the accumulator into memory when executed.

[1]

3. The following assembly code in Fig. 1 is written for the Little Man Computer instruction set.

```
      INP
      STA  arg1
      INP
      STA  arg2
      LDA  arg1
loop  SUB  arg2
      BRP  loop
      ADD  arg2
      OUT
arg1  DAT
arg2  DAT
```

Fig.1

   a. State the output when the inputs are 13 followed by 5.

[1]

   In the line:

```
loop  SUB   arg2
```

   b. State what opcode SUB does.

[1]

   c. Name the register in which the result of this line is stored.

[1]

d. State what the program in Fig.1 does.

[1]

e. Using pseudocode write a program for a procedural language that takes in two inputs and gives the same output as the program in Fig.1.

[2]

f. State what type of translator program would be needed to convert the code above into machine code.

[1]

g. Describe the difference between the STA and LDA instructions.

[2]