5. (a) Discuss the advantages and disadvantages of compiling to a virtual machine (such as JVM) as opposed to straightforward translation to assembly code.

[11]

(b) Consider the following program and function expressed as 3-address code:

```
 x := 11
 y := 13
t1 := x + y
 z := t1 * 2
 a := 17
 b := 19
t2 := a * b
 z := z * t2
```

Perform the register allocation procedure to assign one of the available 3 registers (R_0, R_1, and R_2) for each variable, and show the resulting code. Include code for spilling if needed. Explain any algorithms and criteria that are used.

[14]