

11 Optimising Compilers (TMJ)

(a) Describe abstract interpretation, making reference to the required domains and functions and how safety is maintained. Illustrate your answer through abstract interpretation of the rule-of-signs. [5 marks]

(b) Create an abstraction with three values for deciding whether the result of a calculation definitely divides by 6, definitely does not divide by 6, or may divide by 6. You need only consider multiplication and addition on integers. Show that your abstraction produces the following:

(i)  $(4 + 3) * 6$  does divide by 6.

(ii)  $(2 * 6) + 3$  does not divide by 6.

(iii)  $(5 * 6) + (2 * 3)$  may divide by 6.

[10 marks]

(c) Explain why Part (b)(iii) cannot be computed precisely and then give an alternative abstraction that can correctly identify Part (b)(iii) as divisible by 6. [5 marks]