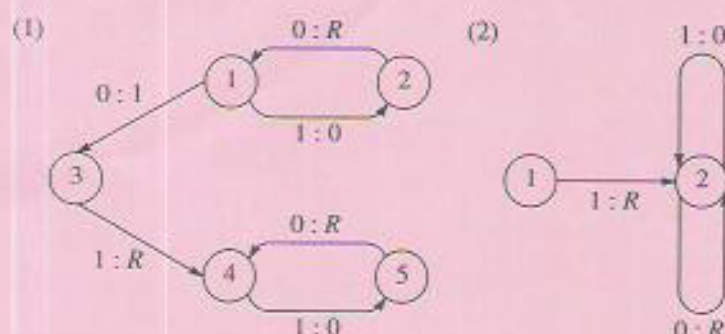


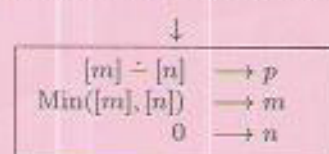
Question 9

- (i) We wish to design a Turing machine which, using monadic notation, takes as input a pair (m, n) of positive integers in standard position (on an otherwise blank tape) and which halts scanning a single 1 on an otherwise blank tape.
- (a) Explain why each of the Turing machines below is *not* suitable for this task. (Your answer may include sequences of configurations for appropriate test data.)



- (b) Give the flowgraph of a Turing machine which correctly performs the task.

- (ii) Give the complete flowchart of an Abacus machine program which has the effect shown in the following block diagram. (You may use extra registers, assumed empty initially, if you wish.)



where $[p] = 0$ initially.

$$\text{where } x \dot{-} y = \begin{cases} x - y, & \text{if } x \geq y, \\ 0, & \text{if } x < y, \end{cases}$$

$$\text{and } \text{Min}(x, y) = \begin{cases} y, & \text{if } x \geq y, \\ x, & \text{if } x < y. \end{cases}$$