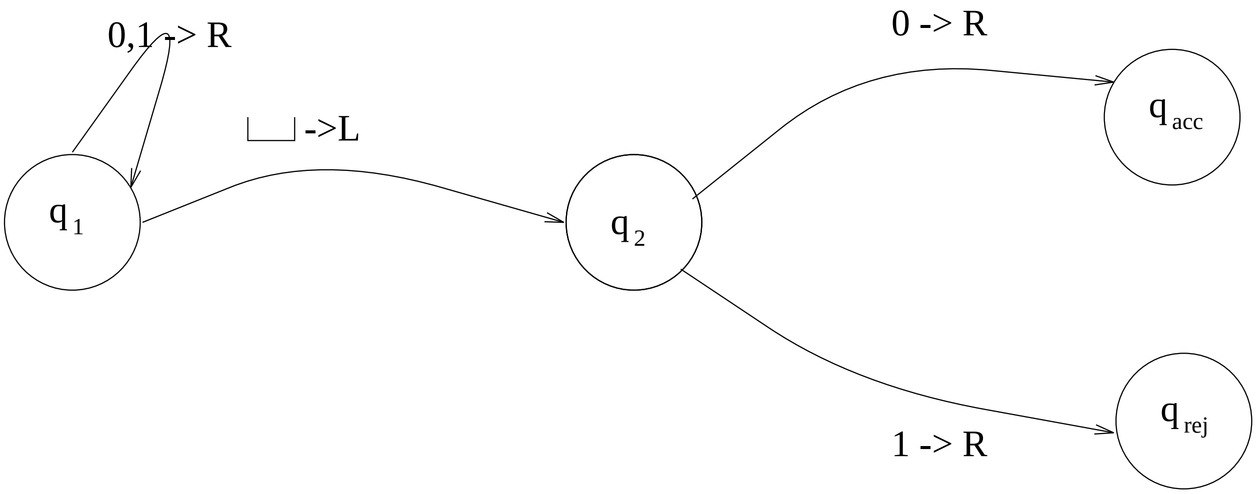
Turing Machine:



RAM program simulating the Turing Machine above:

(Encoding the end of string or empty space in the Turing machine by -1.)

1. LOAD =1
2. STORE 1
3. READ ↑1 (at kth iteration $r_1 = k$ here)
4. STORE 2 ($r_2 := i_k$)
5. LOAD 1
6. ADD =2
7. STORE 1 (at kth iteration $r_1 = k + 2$ here)
8. LOAD 2
9. STORE ↑1 ($r_{k+2} := r_2$ (kth input value))
10. ADD 1
11. JZERO 16 (if $r_0(= r_{k+1}) = -1$ go to 16)
12. LOAD 1
13. SUB 1

14. STORE 1 ($r_1 = k + 1$ here)

15. JUMP 3 (go to 3 for next iteration)

16. LOAD =3

17. STORE 1 ($r_1 := 3$ (the index of register holding the first input))

18. LOAD ↑1 (start simulation or $q_1, 0$)

19. SUB =0

20. JZERO 22 (check if symbol is 0)

21. JUMP 26 (if not go to $q_1, 1$)

22 LOAD 1

23. ADD =1

24. STORE 1 (head move to the right)

25. JUMP 18 (transition to start of state q_1)

26. LOAD ↑1 (start simulation of $q_1, 1$)

27. SUB =1

28. JZERO 30 (check if symbol is 1)

29. JUMP 34 (if not, go to q_1,$\sqcup$)

30. LOAD 1

31. ADD =1

32. STORE 1 (head move to the right)

33. JUMP 18 (transition to start of state q_1)

34. LOAD ↑1 (start simulation of q_1, $\sqcup$)

35. SUB =-1

36. JZERO 38 (check if symbol is $\sqcup$)

37. JUMP 60 (if not, something is wrong; reject)

38. LOAD 1

39. ADD =-1

40. STORE 1 (head move to the left)

41. JUMP 42 (go to $(q_2, 0)$, can be supressed!)

42. LOAD $\uparrow$1 (start simulation of $(q_2, 0)$)

43. SUB =0

44. JZERO 46 (check if symbol is zero)

45. JUMP 50 (if not go to $(q_2, 1)$)

46. LOAD 1

47. ADD =1

48. STORE 1 (move head to right)

49. JUMP 58 (transition to q accept)

50. LOAD $\uparrow$1 (start simulation $(q_2, 1)$)

51. SUB =1

52. JZERO 54 (check if symbol is 1)

53. JUMP 60 (if not, something wrong! reject)

54. LOAD 1

55. ADD =1

56. STORE 1 (move head to the right)

57. JUMP 60 (transition to $q$reject)

58. LOAD =1 (start simulation of $q$accept)

59. HALT $(r_0 = 1)$

60. LOAD =0 (start simulation of $q$reject)

61. HALT $(r_0 = 0)$