Designing Turing Machines

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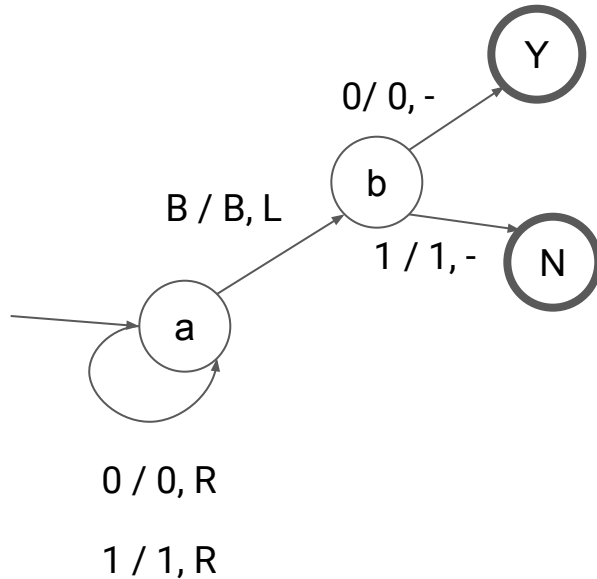
Problem solving

- Each TM is specific to the problem to be solved

  - We only considered decision problems, but this can be generalized to all problems

- For general problems, we need a decoder

  - DEC : Σ* → Output

  - If M halts, we use DEC(tape) as the result of the problem

Example: is an integer number even or odd?

- ENC is to write the number in binary.
- If it's even, then it ends with 0. Otherwise it ends with 1.

General strategy:

- Move to the of string
- Check if it's zero or one

Let's use the halting state to get the answer.

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# Example: is an integer number even or odd?

Let's insist to use tape to determine the answer.

- Write 1 to the beginning of the tape if YES.
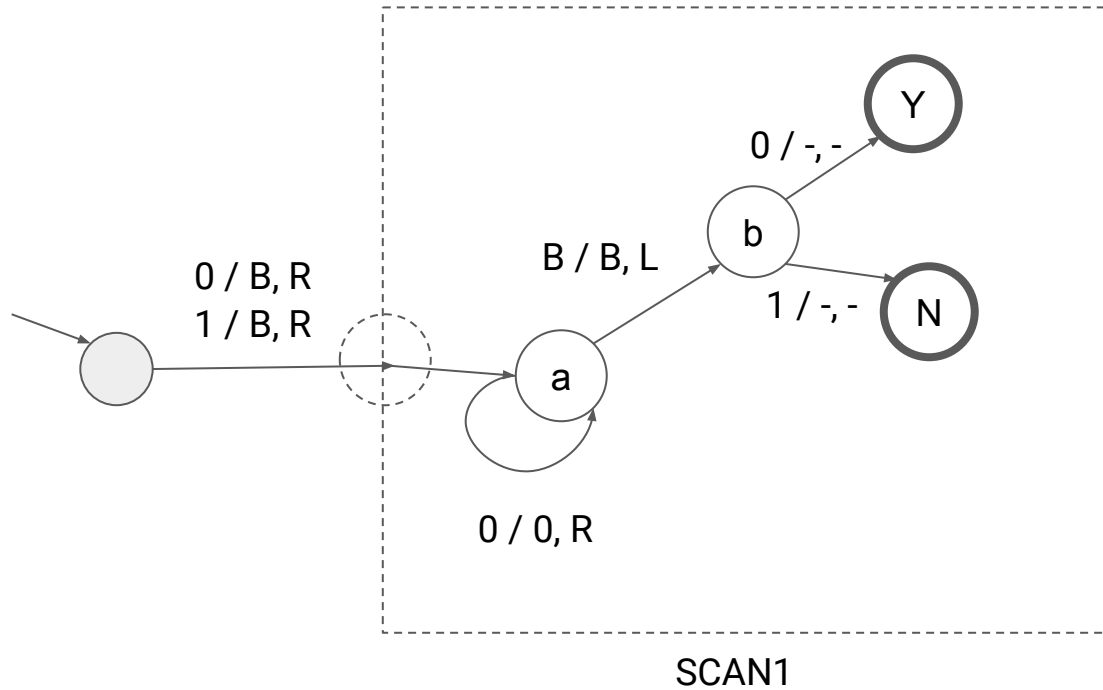- Write 0 to the beginning of the tape if NO.

More specific strategy:

1. Mark the first cell with as BLANK first.
2. Scan the string (left to right) as before to arrive at YES or NO state.
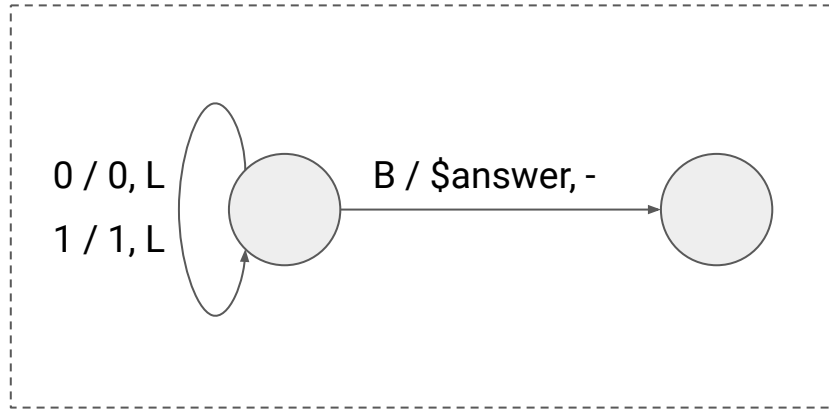3. Scan the string right to left to get back to the first cell. Write down the answer there.

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Mark the first cell

0 / B, R
1 / B, R
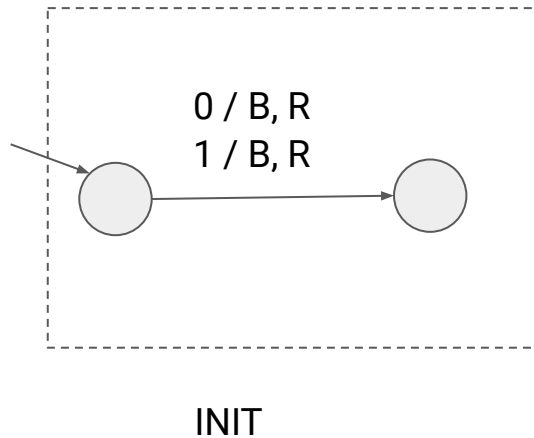
INIT

Scan to the end of string

SCAN1

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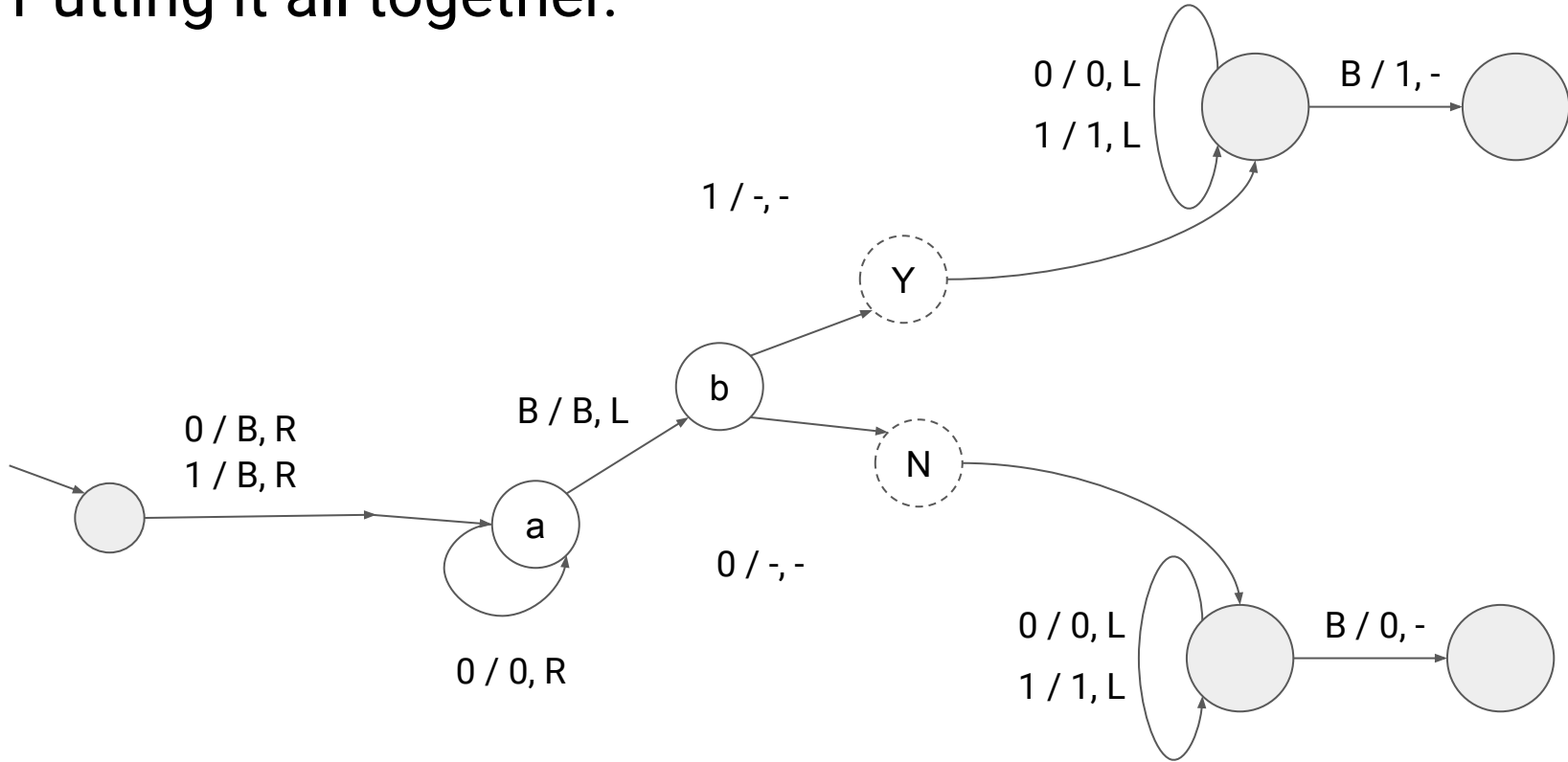# Scan backwards until reaching first cell

SCAN2(answer)

General Strategy

- Scan from right to left
- When encounter BLANK (as initialized by

Putting it all together.

Modularity of TM