COMP170 Spring 2018, Recitation 2 Solutions

It will be assumed that the subroutine GoTo(x) and its many variants has already been established. The first two solutions are written in “implementation-level English”, less detailed than the actual 4-Tuple TM specs, yet more detailed than the style of pseudocode that you would write for a class like Comp11. The latter two solutions move closer to mid-level pseudocode, which is about the level we’re looking for on HW2. For each of these, there are many possible strategies - our solutions are just one possibility.

Increment:

1. Move right down the tape, two squares at a time (RR), until you hit the ‘#’ symbol. Move right one square and write a ‘1’.
2. Move left, one square at a time, writing an ‘x’ on every blank square that you see. Stop when you hit a ‘∅’.
3. Repeat the following steps until you arrive at the ‘#’ symbol without having found an ‘x’:
   (a) Move right until you find an ‘x’, erase it.
   (b) Move right down the tape, two squares at a time (RR), until you hit the first blank. Write a ‘1’ on that square.
   (c) Move left until you hit a ‘∅’.
4. Halt.

Compare:

1. Repeat the following steps until you arrive at the first ‘#’ symbol without having found a blank:
   (a) Move to the right until you until you find a blank. Mark it with an ‘x’.
   (b) From where you wrote the ‘x’, move one square to the left. If it is a ‘1’, go to step c. If it is a ‘0’ go to step d.
   (c) Find a matching 1:
      i. Move right until you find the ‘#’ symbol.
      ii. Move right until you find a blank square. If you hit a ‘#’ before you find a blank, go to the Fail Condition.
      iii. From the blank square, move left one square. If it is a ‘1’, move right one square and write a ‘y’. It is a ‘0’, go to the Fail Condition.
   (d) Find a matching 0:
      i. Move right until you find the ‘#’ symbol.
      ii. Move right until you find a blank square. If you hit a ‘#’ before you find a blank, go to the Fail Condition.
      iii. From the blank square, move left one square. If it is a ‘0’, move right one square and write a ‘y’. It is a ‘1’, go to the Fail Condition.
(e) Move left down the tape until you hit a ‘∅’.

2. Move right until you find the second ‘#’ symbol. If you hit a blank on the way, go to the Fail Condition.

3. Move right one square and write a 1.

4. Move left down the tape until you hit a ‘∅’, erasing any square with an ‘x’ or a ‘y’ on it.

5. Halt.

6. Fail condition:
   (a) Move left until you find a ‘∅’.
   (b) Move right until you find a ‘#’.
   (c) Move right until you find a ‘#’.
   (d) Move right one square and write a 0.
   (e) Move left down the tape until you hit a ‘∅’, erasing any square with an ‘x’ or a ‘y’ on it.
   (f) Halt.

Erase:

1. Move right until you find the ‘#’ symbol.

2. Move right until you find the ‘#’ symbol. Erase it. Move left.

3. Until you hit the ‘#’ symbol:
   (a) Erase the square, move left.

4. Repeat forever since I didn’t include an end marker on the slide:
   (a) Move right until you find any non-blank symbol. Store that symbol as your state (this high-level strategy is now fair game).
   (b) Move left until you find the ‘#’ symbol. Move right one square. If it is blank, write the symbol you stored. If it is not blank, move right down the tape, two squares at a time, until you find the first blank. Write the stored symbol in this square.

Copy:

1. Repeat the following steps until you arrive at the first ‘#’ symbol without having found a blank:
   (a) Move to the right until you until you find a blank. Mark it with an ‘x’.
   (b) From where you wrote the ‘x’, move one square to the left. Store this symbol as your state.
   (c) Move right until you find the ‘#’ symbol.
(d) Move right one square. If it is blank, write the symbol you stored. If it is not blank, move right down the tape, two squares at a time, until you find the first blank. Write the stored symbol in this square.

(e) Move left down the tape until you hit a ‘∅’.

2. Move right one square. If it is blank, write ‘#’. If it is not blank, move right down the tape, two squares at a time, until you find the first blank. Write a ‘#’.

3. Move left down the tape until you hit a ‘∅’, erasing any square with an ‘x’ on it.

4. Halt.