TML Worksheet

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January 31, 2023

1 Writing TML Programs

In this section, you will be tested on writing TML programs. Three programs are given below as examples:

- `isDiv2`:

```
1   // checks whether a binary number is divisible by 2
2   alphabet = {0, 1}
3   module isDiv2 {
4       while 0, 1 {
5           move right
6       } if blank {
7           move left
8           if 0 {
9               accept
10          } if 1, blank {
11              reject
12          }
13      }
14  }
```

- `isDiv2Rec`:

```
1   // checks whether a binary number is divisible by 2 recursively
2   alphabet = {0, 1}
3   module isDiv2 {
4       if 0, 1 {
5           move right
6           goto isDiv2
7       } if blank {
8           move left
9           if 0 {
10              accept
11          } if 1, blank {
12              reject
13          }
14      }
15  }
```

- aNbN:

```
 1  // checks whether the input is blank or of the form ab, aabb, aaabbb, etc.
 2  alphabet = {a, b}
 3  module aNbN {
 4      if blank {
 5          accept
 6      }
 7      // cannot start with a b
 8      if b {
 9          reject
10      } if a {
11          changeto blank
12          move right
13          // go to the end
14          while a, b {
15              move right
16          }
17          if blank {
18              move left
19              // must end with a b
20              if a, blank {
21                  reject
22              } if b {
23                  changeto blank
24                  move left
25                  // go to the start and restart
26                  while a, b {
27                      move left
28                  } if blank {
29                      move right
30                      goto aNbN
31                  }
32              }
33          }
34      }
35  }
```

Following a similar syntax to the code given above, write the following programs. You are free to use the website to check the accuracy of the program while writing the programs.

1. divisibility by 4 in binary iteratively [HINT: Go to the end and check for 2 zeros. Allow 0 as well.]

Solution:

2. palindrome over a, b [HINT: if blank, accept; if single entry, accept; otherwise, remove the first value, go to the end and check that this value is the same. Go to the start and recurse afterwards.]

Solution:

3. divisibility by 4 in binary, recursively.

Solution:

4. check all a's come before the b's.

Solution:

2 Identifying TML Programs

In this section, you are presented with TML programs. You will be given some tape values to run the program in and decode what values the program accepts. You can use the website to try and solve this, but you should attempt executing the program without the website for at least one of the values.

1. Consider the following TML Program:

```
1   alphabet = {0, 1}
2   module mystery {
3      while 0, 1 {
4          move right
5      } if blank {
6          move left
7          if blank, 0 {
8              reject
9          } if 1 {
10             move left
11             if blank, 1 {
12                 reject
13             } if 0 {
14                 accept
15             }
16         }
17     }
18  }
```

(a) Does the program accept the values:

i. 10

> **Solution:**

ii. 1

> **Solution:**

iii. 100

> **Solution:**

iv. 101

> **Solution:**

v. 110

> **Solution:**

(b) Describe the values this program accepts.

> **Solution:**

2. Consider the following TML program:

```
1   alphabet = {a, b}
2   module mystery {
3       if blank {
4           accept
5       } if a {
6           changeto blank
7           move right
8           while a, b {
9               move right
10          } if blank {
11              move left
12              if a {
13                  reject
14              } if b, blank {
15                  changeto blank
16                  move left
17                  while a, b {
18                      move left
19                  } if blank {
20                      move right
21                      goto mystery
22                  }
23              }
24          }
25      } if b {
26          changeto blank
27          move right
28          while a, b {
29              move right
30          } if blank {
31              move left
32              if b {
33                  reject
34              } if a, blank {
35                  changeto blank
36                  move left
37                  while a, b {
38                      move left
39                  } if blank {
40                      move right
41                      goto mystery
42                  }
43              }
44          }
45      }
46  }
```

(a) Does the program accept the values:

i. *ab*

> **Solution:**

ii. *aab*

> **Solution:**

iii. *abb*

> **Solution:**

iv. *abba*

> **Solution:**

v. *abab*

> **Solution:**

(b) Describe the values this program accepts.

> **Solution:**

3   Identifying TMs