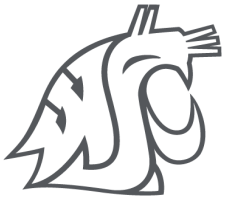

Washington State University

Computer Science 322

Testing document

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Contents

Chapter 1

Valid Turing Machine

1.1 Description:

A valid Turing Machine file

1.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1 s2 s3 s4

INPUT_ALPHABET: a b

TAPE_ALPHABET: a b X Y -

TRANSITION_FUNCTION:
s0 a  s1 X R
s0 Y  s3 Y R
s1 a  s1 a R
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R

INITIAL_STATE: s0

BLANK_CHARACTER: -
```

```
FINAL_STATES: s4
```

1.3 Input string:

aabb

1.4 Expected results:

Input string is accepted in 13 transitions.

1.5 Results:

The input string was accepted in 13 transitions.

1.6 Test successful or Test failed:

Test failed.

Chapter 2

Valid Turing Machine 2

2.1 Description:

A valid Turing Machine file that accepts one 'a' followed by any number of b's than followed by 'a'.

2.2 Definition File:

```
This Turing machine accepts the language
of one 'a' followed by any number of b's than followed by 'a'.

STATES: s0 s1 s2

INPUT_ALPHABET: a b

TAPE_ALPHABET: a b -

TRANSITION_FUNCTION:
s0 a  s1 a R
s1 b  s1 b R
s1 a  s2 a R

INITIAL_STATE: s0

BLANK_CHARACTER: -

FINAL_STATES: s2
```

2.3 Expected results:

The definition to be loaded, 'abba' to be accepted, and 'abbb' to be rejected.

2.4 Results:

The definition loaded without error, 'abba' was accepted, and 'abbb' was rejected.

```
Successfully loaded TM.
Command: i
Input string: abba
String 'abba' inserted into list!
Command: i
Input string: abbb
String 'abbb' inserted into list!
Command: r
Input string number: 1
0. [s0]abba
1. a[s1]bba
Command: r
2. ab[s1]ba
Command: r
3. abb[s1]a
Command: r
4. abba[s2]
Input string abba was accepted in 4 transitions.
Command: r
Input string number: 2
0. [s0]abbb
1. a[s1]bbb
Command: r
2. ab[s1]bb
Command: r
3. abb[s1]b
Command: r
4. abbb[s1]
Command: r
4. abbb[s1]
Input string abbb was rejected in 4 transitions.
```

2.5 Test successful or Test failed:

Test failed.

Chapter 3

Invalid Turing Machine

3.1 Description:

A invalid Turing Machine file

3.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1 s2 s3 s4 s4 []

INPUT_ALPHABET: a b [ ] c

TAPE_ALPHABET: a b X Y Y [ ]

TRANSITION_FUNCTION:
s0 a  s1 X R
s0 Y  s3 Y R
s9 e  s9 e Y
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R

INITIAL_STATE: s9

BLANK_CHARACTER: -
```

```
FINAL_STATES: s4 s4 s9
```

3.3 Expected results:

The file should be rejected because of the following errors:

1. State contains duplicate 's4' and invalid state '[]'.
2. Input Alphabet cannot contain '[' or ']'.
3. Input Alphabet character 'c' is not in the tape alphabet.
4. Tape Alphabet contains duplicate 'Y'.
5. Tape Alphabet cannot contain '[' or ']'.
6. Transition contains an invalid state 's9'.
7. Transition contains read and write character 'e' not from the tape alphabet.
8. Transition contains an invalid direction 'Y'.
9. Initial state 's9' is not in the list of states.
10. Blank Character '-' is not contained within the tape alphabet.
11. Final States contain duplicate 's4' and 's9' is not in the list of states.

3.4 Results:

The following errors were found caught:

```
Error: States must be unique but 's4' is not a unique state.
Error: State contains character '[]' that is reserved.
Error: State contains character '[]' that is reserved.
Error: Tape alphabet must be unique but 'Y' is not unique.
Error: Tape alphabet character '[' is reserved.
Error: Tape alphabet character ']' is reserved.
Error: Transition can only contain L or R not 'Y'.
Error: Blank character '-' is not in the tape alphabet.
Error: Input alphabet character '[' is reserved.
Error: Input alphabet character ']' is reserved.
Error: Input alphabet character 'c' is not in the tape alphabet.
Error: Transition read character 'e' is not in tape alphabet.
Error: Transition write character 'e' is not in tape alphabet.
Error: Transition read character '-' is not in tape alphabet.
Error: Transition write character '-' is not in tape alphabet.
```

```
Error: Transition source state 's9' is not in states.
Error: Transition destination state 's9' is not in states.
Error: Final states must be unique but 's4' is not a unique state.
Error: Final states 's9' is not in the list of states.
Error: Initial state 's9 is not in the list of states.
```

3.5 Test successful or Test failed:

Test failed.

Chapter 4

Valid Turing Machine with mixed case keywords

4.1 Description:

A valid Turing Machine file that has mixed case in the keywords.

4.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STaTeS: s0 s1 s2 s3 s4

InPuT_AlPHaBET: a b

TaPE_ALPHABET: a b X Y -

TRaNSiTiON_FUNCTiON:
s0 a  s1 X R
s0 Y  s3 Y R
s1 a  s1 a R
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R
```

```
INITIAL_STATe: s0

BLANK_CHARACTeR: -

FINAL_STATEs: s4
```

4.3 Expected results:

Successfully loaded TM.

4.4 Results:

```
Successfully loaded TM.
```

4.5 Test successful or Test failed:

Test failed.

Chapter 5

Valid Turing Machine with random formatting

5.1 Description:

A valid Turing Machine file that has randomly put together formatting.

5.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1
s2 s3 s4

INPUT_ALPHABET: a
b

TAPE_ALPHABET:
a
b
X Y -

TRANSITION_FUNCTION:
s0 a  s1 X R s0 Y  s3 Y R
s1 a  s1 a R s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L s2 X
s0 X R
s2 Y  s2 Y L s3 Y  s3 Y R
```

```
s3 -  s4 - R INITIAL_STATE: s0

BLANK_CHARACTER: -
FINAL_STATES:
s4
```

5.3 Expected results:

Successfully loaded TM.

5.4 Results:

```
Successfully loaded TM.
```

5.5 Test successful or Test failed:

Test failed.

Chapter 6

Invalid Turing Machine file with unprintable characters

6.1 Description:

A valid Turing Machine file that has unprintable characters in it.

6.2 Definition File:

```
Turing machine not included because it is unprintable.
There is a unprintable character in each part of the definition.
```

6.3 Expected results:

An error messages that will tell the user that areas contain blank characters.

6.4 Results:

The error messages cover all of the unprintable characters. The transition does not print a error because it would just repeat the states error message.

```
Error: State contains a character that is not printable.
Error: Input alphabet character is not printable.
Error: Tape alphabet character is not printable.
Error: Initial state contains a character that is not printable.
Error: Illegal blank character.
Error: Blank character ' ' is not in the tape alphabet.
Error: Input alphabet character is not printable.
Error: Transition read character '' is not in tape alphabet.
Error: Final state contains a character that is not printable.
```

```
Error: Final states '' is not in the list of states.
Error: Initial state ' is not in the list of states.
```

6.5 Test successful or Test failed:

Test failed.

Chapter 7

Valid input string list

7.1 Description:

A valid input string list that matches with the Turing machine definition file.

7.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1 s2 s3 s4

INPUT_ALPHABET: a b

TAPE_ALPHABET: a b X Y -

TRANSITION_FUNCTION:
s0 a  s1 X R
s0 Y  s3 Y R
s1 a  s1 a R
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R

INITIAL_STATE: s0
```

```
BLANK_CHARACTER: -

FINAL_STATES: s4
```

7.3 Input List:

```
aabb
abbbbb
\
bbaa
aaaaa
```

7.4 Expected results:

No error and the following result from the list command.

```
1. aabb
2. abbbbb
3. \
4. bbaa
5. aaaaa
```

7.5 Results:

```
1. aabb
2. abbbbb
3. \
4. bbaa
5. aaaaa
```

7.6 Test successful or Test failed:

Test failed.

Chapter 8

Invalid input string list

8.1 Description:

A invalid input string list that does not match with the Turing machine definition file.

8.2 Definition File:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1 s2 s3 s4

INPUT_ALPHABET: a b

TAPE_ALPHABET: a b X Y -

TRANSITION_FUNCTION:
s0 a  s1 X R
s0 Y  s3 Y R
s1 a  s1 a R
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R

INITIAL_STATE: s0
```

```
BLANK_CHARACTER: -

FINAL_STATES: s4
```

8.3 Input List:

```
acbb
aabb
ad2bbbbb
\\
bbzaa
aasdaaaa
```

8.4 Expected results:

Warnings that remove all of the input strings but "aabb".

8.5 Results:

```
Successfully loaded TM.
Warning: Input string 'acbb' is not valid and was removed.
Warning: Input string 'ad2bbbbb' is not valid and was removed.
Warning: Input string '\\' is not valid and was removed.
Warning: Input string 'bbzaa' is not valid and was removed.
Warning: Input string 'aasdaaaa' is not valid and was removed.
Command: l
1. aabb
```

8.6 Test successful or Test failed:

Test failed.

Chapter 9

Command Delete Input

9.1 Description:

This tests if a input string can be removed from the input string list using the delete input command. The test removes a input string and uses the list command to make sure it is not on the list.

9.2 Expected results:

The input string is removed from the input string list.

9.3 Results:

The input string was removed from the list.

```
Command: l
1. aabb
2. aaa
Command: d
Input string number: 2
Input string was removed from the list.
Command: l
1. aabb
Command:
```

9.4 Test successful or Test failed:

Test failed.

Chapter 10

Command Exit Application

10.1 Description:

Test that the exit saves the input string list file, if it was modified, and closes the application.

10.2 Expected results:

After a new input string was added, the exit command saves the input string list and closes the application.

10.3 Results:

The input string list was saved and the application closed.

```
Command: i
Input string: aaa
String 'aaa' inserted into list!
Command: x
Input string file successfully saved to disc.
```

10.4 Test successful or Test failed:

Test failed.

Chapter 11

Command Help

11.1 Description:

This test checks to see if the a help message is displayed to the user.

11.2 Expected results:

A message that contains all of the commands to be displayed.

11.3 Results:

A message that contains all of the commands.

```
Command: h
(D)elete   - Delete input string from list.
E(x)it     - Exit application.
(H)elp     - Help user.
(I)nsert   - Insert input string into list.
(L)ist     - List input strings.
(Q)uit     - Quit operation of Turing machine on input string.
(R)un      - Run Turing machine on input string.
S(e)t      - Set maximum number of transitions to perform.
Sho(w)     - Show status of application.
(T)runcate - Truncate instantaneous description.
(V)iew     - View Turing machine.
```

11.4 Test successful or Test failed:

Test failed.

Chapter 12

Command Insert

12.1 Description:

This test checks that a new input string can be added to the list and invalid ones are rejected.

12.2 Expected results:

'ccc' is rejected and 'aaab' is accepted.

12.3 Results:

Only the valid 'aaab' was inserted into the list.

```
Command: i
Input string: ccc
Error: Invalid input string.
Command: i
Input string: aaab
String 'aaab' inserted into list!
Command: l
1.aaab
```

12.4 Test successful or Test failed:

Test failed.

Chapter 13

Command List

13.1 Description:

This test checks that the input strings from the input string file are displayed correctly.

13.2 Expected results:

The output from the list command matches the input string file.

```
Command: l
1. aabb
2. aaa
3. aaab
```

13.3 Results:

The output from the list command does match the input string file.

```
Command: l
1. aabb
2. aaa
3. aaab
```

13.4 Test successful or Test failed:

Test failed.

Chapter 14

Command Quit

14.1 Description:

This test checks that a Turing Machine can be stopped with the quit command.

14.2 Expected results:

The quit command will stop the Turing Machine and when the run command is used a new input string is required.

14.3 Results:

The Turing machine is quit and a new input string is required.

```
Command: r
Input string number: 1
0. [s0]aabb
1. X[s1]abb
Command: q
Input string aabb was not accepted or rejected in 1 transitions.
Command: r
Input string number:
```

14.4 Test successful or Test failed:

Test failed.

Chapter 15

Command Run

15.1 Description:

This test checks that the run command prompts for a input string and if provided with a bad one will cancel the command. If provided with a valid input string index the Turing machine will start. If the Turing machine is already running it will continue it.

15.2 Expected results:

The input string index of 324 is invalid, input string of 1 is valid and the Turing machine starts, and running it again continues.

15.3 Results:

The run command did reject 324, accepted 1 and started Turing machine. Finally it continued when used again on a running Turing machine.

```
Command: r
Input string number: 324
Error: Number is not a index to a input string.
Command: r
Input string number: 1
0. [s0]aabb
1. X[s1]abb
Command: r
2. Xa[s1]bb
```

15.4 Test successful or Test failed:

Test failed.

Chapter 16

Command Set

16.1 Description:

This test checks that the maximum number of transitions changes when the set command is used.

16.2 Expected results:

The command will reject -1 but accept 10. Also when the run command is used it will run 10 transitions.

16.3 Results:

The command rejected -1 but accepted 10. Also it changed the maximum amount of transitions.

```
Command: e
Maximum number of transitions [1]: -1
Error: A non-numerical input entered.
Command: e
Maximum number of transitions [1]: 10
Number of transitions changed to 10.
Command: r
Input string number: 1
0. [s0]aabb
10. XX[s0]YY
```

16.4 Test successful or Test failed:

Test failed.

Chapter 17

Command Show

17.1 Description:

This test checks that the static information is displayed plus the current settings.

17.2 Expected results:

Max Transitions is 10, Truncation is 32, and the Turing Machine is running on 'aabb' for 10 transitions.

17.3 Results:

The static message, max transitions, truncation, and Turing machine status are all displayed correctly.

```
Course name: CPT_S 322
Semester: Spring
Year: 2016

Instructor: Neil Corrigan
Author: David Harkins

Version number: 3
Max transitions: 10
Max cells to left and right: 32

Name of TM: TM_DATA
TM Status: Running.
Currently running on the input string 'aabb' for 10 transitions.
```

17.4 Test successful or Test failed:

Test failed.

Chapter 18

Command Truncate

18.1 Description:

This test checks that the truncation command changes the maximum number on each side that are displayed.

18.2 Expected results:

The command to reject the value of -1 and accept the value of 1.

18.3 Results:

The command did reject the invalid value and accepted the valid. The command saved the value which can be proven by the run command only displaying one character.

```
Maximum number of cells [1]: -1
Error: A non-numerical input entered.
Command: t
Maximum number of cells [10]: 1
Setting changed to 1.
Command: r
13. <-[s4]
Input string aabb was accepted in 13 transitions.
```

18.4 Test successful or Test failed:

Test failed.

Chapter 19

Command View

19.1 Description:

This test checks that the view command displays the Turing Machine definition file that was loaded.

19.2 Expected results:

Expected to be displayed is the same data to the this definition but in different formatting:

```
This Turing machine accepts the language
of one or more a's followed by the same number of b's.

STATES: s0 s1 s2 s3 s4

INPUT_ALPHABET: a b

TAPE_ALPHABET: a b X Y -

TRANSITION_FUNCTION:
s0 a  s1 X R
s0 Y  s3 Y R
s1 a  s1 a R
s1 b  s2 Y L
s1 Y  s1 Y R
s2 a  s2 a L
s2 X  s0 X R
s2 Y  s2 Y L
s3 Y  s3 Y R
s3 -  s4 - R
```

```
INITIAL_STATE: s0

BLANK_CHARACTER: -

FINAL_STATES: s4
```

19.3 Results:

The information displayed is the same as from the definition file.

```
Command: v
This Turing machine accepts the language of one
or more a's followed by the same number of b's.

Q = {s0, s1, s2, s3, s4}

Sigma = {a, b}

Gamma = {a, b, X, Y, -}

Delta(s0, a) = (s1, X, R)
Delta(s0, Y) = (s3, Y, R)
Delta(s1, a) = (s1, a, R)
Delta(s1, b) = (s2, Y, L)
Delta(s1, Y) = (s1, Y, R)
Delta(s2, a) = (s2, a, L)
Delta(s2, X) = (s0, X, R)
Delta(s2, Y) = (s2, Y, L)
Delta(s3, Y) = (s3, Y, R)
Delta(s3, -) = (s4, -, R)

Q0 = s0

B = -

F = {s4}
```

19.4 Test successful or Test failed:

Test failed.