UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

CURTLE

-Cool Turtle -

Urcan Diana-Cristina

Group 30236

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

Cuprins

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

1. Introduction

Curtle (Cool Turtle) is a learning bot for 6th graders, contains basic mathematic operations – is going to help kids to solve calculation problems, teach them different percepts, presenting definitions and examples.

It's an interactive bot, which tries its best in order to understand kid's problems. There are many predefined operations and explanations for dynamic interaction between kid and bot – meaning that each pupil may introduce numbers and then ask curtle to show him the prime, odd, even, etc. values. Curtle can also test the children, giving 5 questions, each with 2p value.

Technology

Lex – A Lexical Analyzer Generator

- ➔ Lex helps write programs whose control flow is directed by instances of regular expressions in the input stream. Lex source is a table of regular expressions and corresponding program fragments.
- ➔ The table is translated to a program which reads an input stream, copying it to an output stream and partitioning the input into strings which match the given expressions. As each such string is recognized the corresponding program fragment is executed.

Yacc – Yet another Compiler-Compiler

- ➔ Yacc provides a general tool for describing the input to a computer program.
- ➔ User specifies the structures of his input, together with code to be invoked as each such structure is recognized. Yacc turns such a specification into a subroutine that handles the input process.

Why?

I really wanted to create something on my own, I didn't really had much experience with Lex&Yacc and I wanted to learn and practice more. The fact that I could use my imagination so much made me really enthusiast.

2. Rules

- ✓ curtle, come!
  - ➢ Starts the program by calling curtle for help
  - ➢ If you do not call the turtle, no command will work

- ✓ curtle, go!
  - ➢ Ending the program by sending back curtle

- ✓ curtle, say calculation
  - ➢ Asking curtle to help doing a mathematical calculation
    - Calculation can be any mathematical operations with numbers, that contain +, -, /, %, *, sqrt.

- ✓ curtle, float value
  - ➢ Asking curtle to take 'value' numbers from you in order to perform different operations on them and tell you what are those values

- ✓ curtle, tell me 'about'
  - ➢ Asking curtle to print from your values, which values are 'about' (e.g. odd, even)

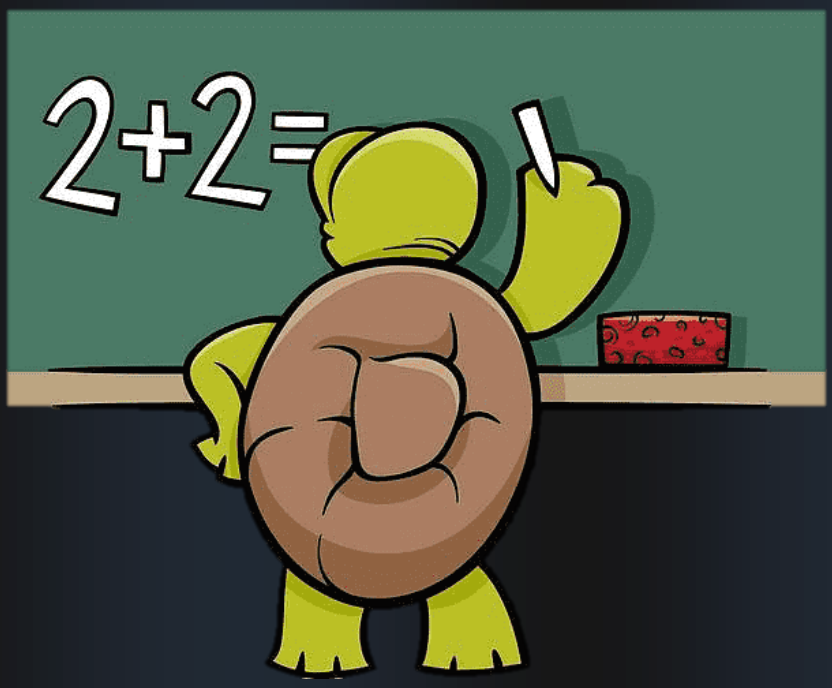
- ✓ curtle, teach me knowledge
  - ➢ Asking curtle to explain you 'knowledge' – give you a definition and some examples
    - practice
      - after saying you want to learn something, you can test your knowledge on that subject by asking for a problem
    - 'answer' – e.g. 'yes' or 'no'
      - usually, you are asked to answer with yes/no
    - explain
      - you can ask turtle to give you explanation for the given solution

- ✓ my values
  - ➢ Curtle prints all values which were entered by you

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

- ✓ SET OPERATIONS
  - ➢ Set operations are defined by set 'operator' set
    - set + set
      - Union of set and set
    - set | set
      - Intersection of set and set
    - set / set
      - Exclude second set from first set
    - set x set
      - Cartesian product
    - set
      - Tells general information about set – cardinality, validity.
      - Set is expected as {value, value2, etc.}, or empty set {}

- ✓ curtle, test me
  - ➢ asking curtle to give you a "final test" which contains random questions from existing database; you will receive 5 questions, each waiting for your answer, and marked as note out of 2p.
  - ➢ after finishing the test, your mark will be displayed as a score of mark/100.



3. Implementation

Curtle is a Lex&Yacc project, Lex contains the rules and sends tokens to Yacc file, after parsing the input command. In Yacc are used some external headers and .C files.

Files used:

- Non-relational database
  - File 'knowledge.xml' is a non-relational database which contains information about mathematical terms
  - Teaching – knowledge
    - <about> tag is for item's name (like: prime, odd)
    - <definition> is for definition and examples
  - Test – questions and answers
    - <question> tag is for the question
    - <correct> holds the correct answer
- XML2C.c
  - Contains operation for extracting data from 'knowledge.xml' where are kept definitions and terms to be presented
  - There are four structures used: two for keeping data for each new learning item, and two for test data:

  - Knowledge

```
struct XML_node {
    char* about;
    char* definition;
    char* test;
    char* solution;
    char* explain;
};
```

    - about - is the name of the knowledge
    - definition – definition of the knowledge
    - test – practice problem for that item
    - solution – solution of the problem
    - explain – explanation of the solution

```
struct XML_nodeList {
    struct XML_node **data;
    int size;
};
```

    - data – the list with all the node elements – all knowledge
    - size – size of the knowledge

- Test data

```
struct XML_question {
    char* text;
    char* correct;
};
```

  - text – the question from the test
  - correct – the correct answer

```
struct XML_test {
    struct XML_question **questions;
    int count;
};
```

  - questions – all questions from the database
  - count – number of questions

- Read file function is for getting the database file
- Node structure function is for parsing all file content and returning a structure of XML_nodeList that is formed with every single XML_node from file
- This data is required in the beginning of the program, and locally retained in a structure

- curtle.h and curtle.c
  - curtle.h contains method's headers
  - curtle.c contains implementation for a queue that is going to be used in order to keep values entered by the user

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

4. Results

Running commands

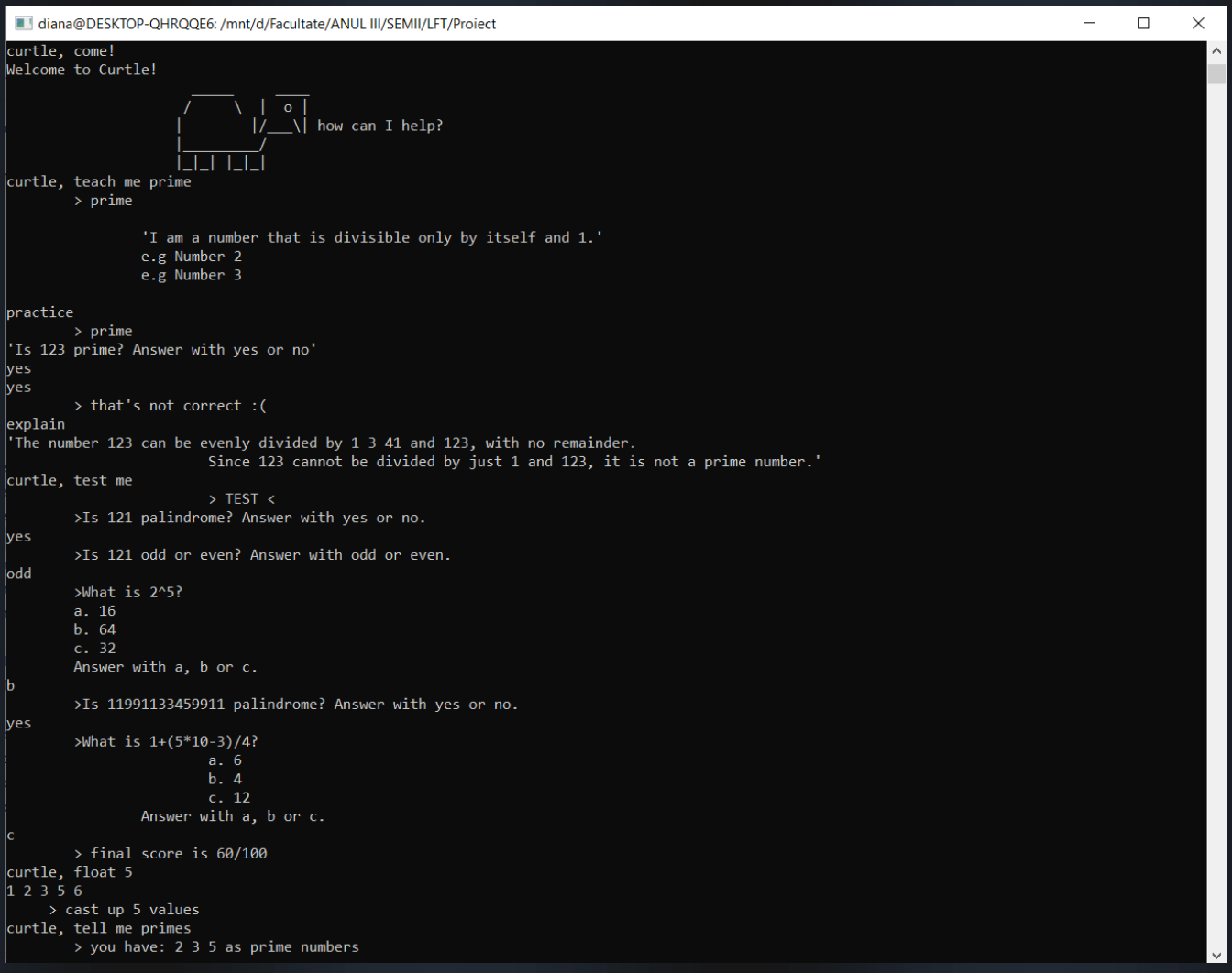
yacc -d proiect.y

lex -o proiect.c proiect.l

gcc proiect.c y.tab.c -ll -lm

./a.out

Examples



```
curtle, tell me primes
        > you have: 2 3 5 as prime numbers
curtle, teach me palindrome
        > palindrome

                'I am a word, phrase, a number, or sequence that reads the same backwards as forwards.'
                e.g Number 12321
                e.g Sentence 'madam or nurses run'

practice
        > palindrome
'Is 12291 palindrome? Answer with yes or no'
no
no
        > you're right! congrats!
curtle, say 192/3+(273*2-120)
 ___   _
/___\/_'|..result is: |_490_|
() ()

my values
        > 1 2 3 5 6
curtle, float 10
12 142 10 5 100 41 198 190 9 23
     > cast up 10 values
my values
        > 12 142 10 5 100 41 198 190 9 23 1 2 3 5 6
```

```
diana@DESKTOP-QHRQQE6:/mnt/d/Facultate/ANUL III/SEMII/LFT/Proiect$ ./a.out
curtle, come!
Welcome to Curtle!
                    _____     ___
                   /     \   |  o |
                  |       |/___\| how can I help?
                  |_______/
                  |_|_| |_|_|

{1,2,3,4}+{1,10,9}
        > Union is: {1,2,3,4,10,9}
{1,5,2,5,10}
        > not a valid set
            duplicates: 5
{1,2,34}|{1,10,123}
        > Intersection is: {1}
curtle, teach me set
        > set

                'In mathematics, a set is a collection of distinct elements.'
                Notation: capital letter (optional indices) followed by braces and between braces: the elements, separated by comma.
                e.g A = {4, 2, 1, 3}
                e.g B = {1, 2, 1, 3} - B is not a set, it contains duplicate 1.
                ! Order is not important !

practice
        > set
'Is {1, 2, 13, 127, 2, 50} a set? Answer with yes or no'
yes
yes
        > that's not correct :(
explain
'It contains duplicates - 2 in 2 positions.'
```

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA

diana@DESKTOP-QHRQQE6: /mnt/d/Facultate/ANUL III/SEMII/LFT/Proiect

```
'Is {1, 2, 13, 127, 2, 50} a set? Answer with yes or no'
yes
        > that's not correct :(
explain
'It contains duplicates - 2 in 2 positions.'
curtle, test me
                        > TEST <
        >Is 11991133459911 palindrome? Answer with yes or no.
yes
        >Is 121 odd or even? Answer with odd or even.
odd
        >Is 121 palindrome? Answer with yes or no.
no
        >What is the value of the following expression when p = 9?
                                                6p + 5
        a. 49
        b. 54
        c. 59
        d. 68
c
        >Is 13 palindrome? Answer with yes or no.
no
        > final score is 40/100
curtle, test me
                        > TEST <
        >
                1) Use the number 1 as the first term.
                2) To find any other term, double the previous term and add 2.
        The first two numbers in the pattern are 1 and 4. What is the 4th number in the
pattern?
                a. 20
                b. 22
                c. 44
                d. 46
b
        >Is 121 odd or even? Answer with odd or even.
odd
        >If x = 3, what is the value of the following expression?
                                                3x^2+2
                a. 17
                b. 20
                c. 29
                d. 83
c
        >What is the value of the following expression when p = 9?
                                                6p + 5
        a. 49
        b. 54
        c. 59
```

```
        >What is the value of the following expression when p = 9?
                                                6p + 5
        a. 49
        b. 54
        c. 59
        d. 68
b
        >What is the mode for the following set of data?
                        2.4, 1.3, 3.9, 3.1, 4.2, 6.4, 1.4,
                        4.6, 2.9, 1.5, 3.6, 6.3, 1.3, 5.1
                a. 4.6
                b. 2.4
                c. 1.4
                d. 1.3
c
        > final score is 60/100
```

5. Conclusions

Curtle is a learning bot that needs some improvement too, more rules, extending on more than 6th graders knowledge, but for the moment, it is a useful bot that can help with basic calculation, definitions and interactive solving questions.