236319 - Programming Languages - HW02

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Question 1

For convenience, we'll mark the rules as follows:

1. `<statements> = <statement> <statements> | <statement>`
2. `<statement> =` ✍️ `<variable>` ⬅️ `<expression>`
3. `<statement> =` 📖 `<expression>`
4. `<expression> =` ↪️ `<variable>`
5. `<expression> = <term>`
6. `<expression> = <expression> <operation> <expression>`
7. `<variable> =` 📗|📘|📙|📕|📔
8. `<term> =` 😇|🙂|😐|😕|🙁|☹️|😣
9. `<operation> =` ➕|➖|✖️|➗

Where "1.1" refers to the first derivation of rule no. 1.

1.

Start Symbol: `<statements>`.
Terminals: ✍️, ⬅️, 📖, ↪️, 📗, 📘, 📙, 📕, 📔, 😇, 🙂, 😐, 😕, 🙁, ☹️, 😣, ➕, ➖, ✖️, ➗.
Non-Terminals: `<statements>`, `<statement>`, `<expression>`, `<variable>`, `<term>`, `<operation>`.

2.

a. No

Every `<statements>` starts with a `<statement>`, which, in turn, starts with either a ✍️ or 📖. This series of terminals doesn't begin with either, so it doesn't belong in this grammar.

b. No

Every notebook emoji comes from a variable, and every variable needs either a ↪️ or a ✍️ before it according to the grammer. On line 3 there's a notebook with a ⬅️ before it, which can't be in this grammer.

c. Yes

`<statements>`

↓ 1.1

```
<statement>
<statements>
```

↓
↓ 1.1

```
<statement>
<statement>
<statements>
```

↓
↓
↓ 1.2

```
<statement>
<statement>
<statement>
```

↓ 2.1
↓ 3.1
↓ 2.1

✍️ <variable> ⬅️ <expression>
📖 <expression>
✍️ <variable> ⬅️ <expression>

↓ 7.4 5.1
↓ 6.1
↓ 7.1 6.1

✍️ 📕 ⬅️ <term>
📖 <expression> <operation> <expression>
✍️ 📗 ⬅️ <expression> <operation> <expression>

↓ 8.4
↓ 5.1 9.3 6.1
↓ 5.1 9.2 5.1

✍️ 📕 ⬅️ 😕
📖 <term> ✖️ <expression> <operation> <expression>
✍️ 📗 ⬅️ <term> ➖ <term>

↓
↓ 8.7 4.1 9.2 5.1
↓ 8.2 8.2

✍️ 📕 ⬅️ 🙁
📖 😒 ✖️ 🔄 `<variable>` ➖ `<term>`
✍️ 📗 ⬅️ 🙂 ➖ 🙂

↓
↓ 7.4 8.1
↓

✍️ 📕 ⬅️ 🙁
📖 😒 ✖️ 🔄 📕 ➖ 😇
✍️ 📗 ⬅️ 🙂 ➖ 🙂

d. No

"😡" is not a terminal, and so any string that contains it does not belong in EmojiLang.

3. Yes

For example: "📖 🙂 ➕ 🙂 ➕ 🙂" is ambiguous. Because this can come to be in 2 different ways:

`<statements>`

↓ 1.2

`<statement>`

↓ 3.1

📖 `<expression>`

↓ 6.1

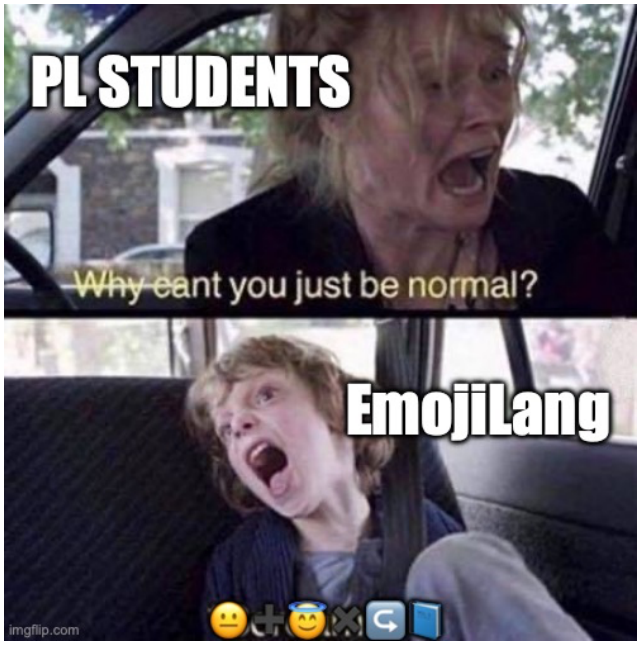
📖 `<expression>` `<operation>` `<expression>`

From here we can break either the left or right `<expression>` to " `<expression>` `<operation>` `<expression>` " (using 6.1), which will create 2 different trees (with possibly 2 different meanings).

Question 2

1. The " `#` " function in SML casts a `string` to a `char`, but the " `^` " function expects 2 strings.
2. The " `/` " function expects 2 `real` s, but both 84 and 2 are `int` s.
3. Comparing `x` and `0` leads us to believe `x` is of type `int`, but the function can either return `x` or `false` (depending on the value of `x`), which is forbidden in SML since a function can only have a single return type (`x` is `int`, `false` is `bool`).
4. Comparing `x` and `#"a"` leads us to believe `x` is of type `char`, but further on we try to use `^` on it, which only accepts `string` types as arguments.
5. The `-` in SML means subtraction, not negation (negation is `~`), and so `(-3)` is not a valid expression.
6. The function `Math.sqrt` expects a `real` as an argument, but `9` is of type `int`.
7. `sin` is not a defined function in SML.
8. `if` is a reserved word in SML, and cannot be used as a value name.
9. The function `String.sub` returns the `char` at the specified index of a string. The index of the last character in `"hello"` is 4, and so trying to take the 5th character isn't allowed.
10. The `Math.sqrt` function's return type is `real`, although the function `sqrt_of_int` is set to return an `int`.

Rejected Memes




ME: TRYING TO WRITE
THE DRY PART IN LATEX
THE STAFF: 😇|🙂|😐|😕|🙁|☹️|😣
imgflip.com