Formal (Somewhat) Definition for Pooka Language Syntax

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1 Lexical Elements

1.1 Identifiers

`<ident>`

An identifier is a string of characters that starts with one of the below:

- A Unicode alphanumeric that is not an ASCII numeric
- A Unicode emoji
- An ASCII underscore

An identifier can then be followed by one of the below:

- Any of the above
- An ASCII numeric
- An ASCII single quote

An identifier cannot be a boolean literal or a keyword.

1.2 Literals

`<lit> := <int lit>|<float lit>|<string lit>|<char lit>|<bool lit>`

1.2.1 Integer Literals

`<int lit>`

An integer literal starts with either a base prefix or an ASCII numeric, as listed below:

1. `0b`: Binary
2. `0o`: Octal
3. `0d`: Decimal
4. `0x`: Hexadecimal
5. Any ASCII numeric: Decimal

- For case 1 to 4:
  - It must be followed by a string of characters of that specific base.
- For case 5:
  - It may then be followed by a string of ASCII numerics.

It may then be followed by the character `e`, if so, it must then be followed by a string of ASCII numerics.

If a sequence of character start with an ASCII numeric, but is not a valid number literal or floating point literal, and it otherwise satisfies the requirement of being an identifier, it is an invalid integer literal.

1.2.2 Floating Point Literals

`<float lit>`

A floating point literal starts with an ASCII numeric, followed by an ASCII period, followed by another string of ASCII numerics.

It may then be followed by the character `e`, if so, it must then be followed by a string of ASCII numerics.

1.2.3 Character Literals

`<char lit>`

A character literal starts with an ASCII single quote sign, followed by either one Unicode character or an string escape sequence, followed by another single quote sign.

1.2.4 String Literals

`<string lit>`

A string literal starts with an ASCII double quote sign, followed by a sequence of either Unicode characters or string escape sequence, followed by another single quote sign.

1.2.5 String Escape Sequence

Valid string escape sequences are:

- `\n`: Newline
- `\r`: Carrige return
- `\t`: Horizontal tab
- `\v`: Vertical tab
- `\\`: Backslash
- `\0`: Null
- `\x`, followed by 2 hexadecimal digits
- `\u{`, followed by 2 to 6 hexadecimal digits, followed by `}`

1.2.6 Boolean Literal

`<bool lit>`

Boolean literals are `true` or `false`.

1.3 Macro Directives

`<@ident>`

Macro directive starts with a `@`, it can then be followed by:

- A Unicode alphanumeric that is not an ASCII numeric
- A Unicode emoji
- An ASCII underscore
- An ASCII single quote

1.4 Parenthesis

A parenthesis is one of the following characters:

- `{`
- `}`
- `[`
- `]`
- `(`
- `)`

1.5 Punctuations

```
<punct> := <unreserved punct> | <reserved punct>
```

A punctuation is a sequence of characters that satisify **all** follow requirements:

- All characters are in the sequence are Unicode punctuation characters, this includes:
  - ASCII Punctuations
  - Unicode General Punctuations
  - Unicode Supplemental Punctuations
  - Unicode Mathematical Operators
  - Unicode Supplemental Mathematical Operators
- Does not contain `{ } [ ] ( ) , ;`
- Does not start with an ASCII single quote or double quote

Some punctuations are reserved (`<reserved punct>`), the rest are not (`<unreserved punct>`). This distinction is made to make room in the syntax for a potential future expansion of custom operators, for this reason occurance of `<unreserved punct>` in source code is considered invalid in the current version.

Note that `,` and `;` are in its whole reserved punctuations, as two exceptions to the above requirements. The intend of this rule being that character sequences like `,&` are treated as two tokens instead of one.

- `,`
- `.`
- `=`
- `:=`
- `:`
- `::`
- `*`
- `~`
- `&`
- `|`
- `^`
- `>>`
- `<<`
- `>>=`
- `<<=`

- &=
- |=
- ^=
- !
- &&
- ||
- +
- -
- /
- %
- +=
- -=
- *=
- /=
- %=
- >
- <
- >=
- <=
- ==
- !=
- ->
- @

2 Syntax

2.1 Types

```
<ty> := <ident>
      | &<ident>
      | &mut <ident>
      | [<ty>]
      | &mut [<ty>]
      | ({<ty>},*)
      | struct \{ <pat ty pairs> \}
      | union \{ <pat ty pairs> \}
      | enum \{ {<ident>(<ty>)},* \}
```

2.2 Patterns

```
<pat> := <ident>
       | mut <ident>
       | ({<pat>},*)

<pat ty pairs> := {<pat>:<ty>},*
```

2.3 Expressions

```
<expr> := <ident>
        | <lit>
        | <op expr>
        | ({<expr>},*)
```

2.4 Assignments

```
<assign> := <pat> = <expr> ;

<expr> := <ident>
        | <lit>
        | <op expr>
        | ({<expr>},*)
        | <if>
        | <loop>
```

2.5 Statements and Blocks

```
<stmt> := <expr> ;
        | <var decl>
        | <fn decl>
        | <typealias>
        | <newtype>
        | <if>
        | <loop>
        | <while>

<block> := \{ {<stmt>}* \};
```

2.6 Variable Declarations

```
<var decl> := <pat> : <ty> {= <expr>}? ;
            | <pat> {:=}|{: =} <expr> ;
```

2.7 Function Declarations

```
<fn decl> := <ident> :: (<pat ty pairs>) {= <expr> ;}|{<block>}|{;}
```

2.8 Type/Typealias Statements

```
<newtype> := type <ident> = <ty> ;
```

```
<typealias> := typealias <ident> = <ty> ;
```

2.9 If

```
<if> := if <expr> <block> {else <block>}?
```

2.10 Loop

```
<loop> := loop <block>
```

2.11 While

```
<while> := while <expr> <block>
```