

SE2062 – Programming Paradigms

Take-Home Assignment: Building a DSL and HTML Form Generator with Lex and Yacc

IT23223394-BSKJ Perera

Link to the video demo

https://drive.google.com/file/d/12Ecchcn14n5kq-gV8M_cAzySNhUW1VLj/view?usp=sharing

Grammar definitions (BNF / EBNF)

FormLang++ EBNF Grammar

Terminals

ID := [a-zA-Z_][a-zA-Z0-9_]*

STRING := "[^"]*"

NUMBER := [0-9]+

BOOL := "true" | "false"

FIELD_TYPE := "text" | "email" | "number" | "date" | "checkbox" | "radio" | "password" | "file" | "textarea" | "dropdown"

Non-Terminals

Form Structure

Form := "form" ID "{" OptionalMeta Sections Validations "}"

OptionalMeta := "meta" ID "=" STRING ";" | ϵ

Sections := Section*

Section := "section" ID "{" Fields "}"

Fields := Field*

Field := "field" ID ":" FieldType AttributeList ";"

Field Types and Attributes

FieldType := FIELD_TYPE

AttributeList := Attribute*

Attribute := "required"

| "required" "=" BOOL

| "default" "=" STRING

| "default" "=" BOOL

| "pattern" "=" STRING

| "min" "=" NUMBER

| "max" "=" NUMBER

| "rows" "=" NUMBER

| "cols" "=" NUMBER

| "options" "=" "[" OptionList "]"

| "accept" "=" STRING

OptionList := STRING ("," STRING)*

Validation Rules Validations := ValidationBlock*

ValidationBlock := "validate" "{" ValidationStatements "}"

ValidationStatements := ValidationStatement*

ValidationStatement := "if" "(" Expression ")" "{" ErrorStatement "}"

ErrorStatement := "error" STRING ";"

Expression := ID ComparisonOp NUMBER

ComparisonOp := "<" | ">" | "<=" | ">=" | "==" | "!="

Lexical Rules

Keywords: form, meta, section, field, validate, if, error

Attributes: required, default, pattern, min, max, rows, cols, options, accept

Operators: =, ==, !=, , <=, >=

Delimiters: {, }, [,], (,), ;, :, ,

Whitespace: [\t\r\n]+ (ignored)

Grammar Properties

- Start Symbol: Form
- Context-Free: Yes, all productions follow $A \rightarrow \alpha$ format
- Deterministic: Designed for LALR(1) parsing
- Left-Recursive: Avoided to prevent parser conflicts
- Ambiguity: Resolved through precedence and associativity rules

Sample inputs and outputs

1.

Main input

```
form PoetrySubmission {
```

```
    meta author = "Poetry Contest Committee";
```

```
    section ContestantDetails {
```

```
        field contestantName: text required;
```

```
        field emailAddress: email required;
```

```
        field age: number min=13 max=99 required;
```

```
        field birthDate: date required;
```

```
        field phone: text;
```

```
        field userPassword: password required;
```

```
    }
```

```
    section PoetrySubmission {
```

```
        field poemTitle: text required;
```

```
        field poemContent: textarea rows=15 cols=60 required;
```

```
    field category: radio required options=["Sonnet", "Haiku", "Free Verse", "Limerick",
"Epic"];
    field previouslyPublished: checkbox default=false;
    field language: dropdown required options=["English", "Spanish", "French", "German",
"Other"];
    field manuscriptFile: file accept=".pdf,.doc,.docx" required;
}
```

```
section ContactPreferences {
    field preferredContact: radio required options=["Email", "Phone", "Mail"];
    field newsletter: checkbox default=true;
    field emergencyContact: text;
    field specialRequests: textarea rows=3 cols=40;
}
```

```
validate {
    if (age < 13) {
        error "Contestants must be at least 13 years old to participate.";
    }
    if (age > 99) {
        error "Invalid age provided.";
    }
}
}
```

Main output

```
<!DOCTYPE html>
<html>
<head>
<title>PoetrySubmission</title>
<style>
```

```

body { font-family: Arial, sans-serif; margin: 20px; background-color: #f5f5f5; }

.form-container { max-width: 800px; margin: 0 auto; background: white; padding: 30px; border-
radius: 10px; box-shadow: 0 0 10px rgba(0,0,0,0.1); }

fieldset { margin: 20px 0; padding: 20px; border: 2px solid #ddd; border-radius: 8px; }

legend { font-weight: bold; font-size: 1.3em; color: #333; padding: 0 10px; }

label { display: block; margin: 12px 0; font-weight: 500; }

input, textarea, select { margin: 5px; padding: 8px; border: 1px solid #ccc; border-radius: 4px;
font-size: 14px; }

input[type='submit'] { background-color: #007bff; color: white; padding: 12px 30px; border:
none; border-radius: 5px; cursor: pointer; font-size: 16px; }

input[type='submit']:hover { background-color: #0056b3; }

.radio-group, .checkbox-group { margin: 10px 0; }

.radio-group input, .checkbox-group input { margin-right: 8px; }

.error { color: red; font-size: 0.9em; margin-top: 5px; }
</style>

<script>

function validateForm() {

    var age = document.forms['PoetrySubmission']['age'].value;

    if (age < 13) {

        alert('Contestants must be at least 13 years old to participate.');
        return false;

    }

    if (age > 99) {

        alert('Invalid age provided.');
        return false;

    }

    return true;

}

</script>

</head>

<body>

```

```

<div class='form-container'>
<form name="PoetrySubmission" method="post" onsubmit="return validateForm()">
<h1>PoetrySubmission</h1>
<!-- Meta: author = Poetry Contest Committee -->
<fieldset>
<legend>ContestantDetails</legend>
<label>contestantName: <input type="text" name="contestantName" required></label><br>
<label>emailAddress: <input type="email" name="emailAddress" required></label><br>
<label>age: <input type="number" name="age" min="13" max="99" required></label><br>
<label>birthDate: <input type="date" name="birthDate" required></label><br>
<label>phone: <input type="text" name="phone" ></label><br>
<label>userPassword: <input type="password" name="userPassword" required></label><br>
</fieldset>
<fieldset>
<legend>PoetrySubmission</legend>
<label>poemTitle: <input type="text" name="poemTitle" required></label><br>
<label>poemContent:<br><textarea name="poemContent" rows="15" cols="60"
required></textarea></label><br>
<label>category:</label><br>
<div class='radio-group'>
<label><input type="radio" name="category" value="Sonnet" required> Sonnet</label><br>
<label><input type="radio" name="category" value="Haiku" required> Haiku</label><br>
<label><input type="radio" name="category" value="Free Verse" required> Free
Verse</label><br>
<label><input type="radio" name="category" value="Limerick" required>
Limerick</label><br>
<label><input type="radio" name="category" value="Epic" required> Epic</label><br>
</div>
<div class='checkbox-group'><label><input type="checkbox" name="previouslyPublished" >
previouslyPublished</label></div>
<label>language: <select name="language" required >

```

```
<option value="English">English</option>
<option value="Spanish">Spanish</option>
<option value="French">French</option>
<option value="German">German</option>
<option value="Other">Other</option>
</select></label><br>
<label>manuscriptFile: <input type="file" name="manuscriptFile" accept=".pdf,.doc,.docx"
required></label><br>
</fieldset>
<fieldset>
<legend>ContactPreferences</legend>
<label>preferredContact:</label><br>
<div class='radio-group'>
<label><input type="radio" name="preferredContact" value="Email" required>
Email</label><br>
<label><input type="radio" name="preferredContact" value="Phone" required>
Phone</label><br>
<label><input type="radio" name="preferredContact" value="Mail" required> Mail</label><br>
</div>
<div class='checkbox-group'><label><input type="checkbox" name="newsletter" checked>
newsletter</label></div>
<label>emergencyContact: <input type="text" name="emergencyContact" ></label><br>
<label>specialRequests:<br><textarea name="specialRequests" rows="3"
cols="40"></textarea></label><br>
</fieldset>
<!-- Validation: Contestants must be at least 13 years old to participate. -->
<!-- Validation: Invalid age provided. -->
<input type="submit" value="Submit Form">
</form>
</div>
</body>
```

```
</html>
```

2.

example_minimal input

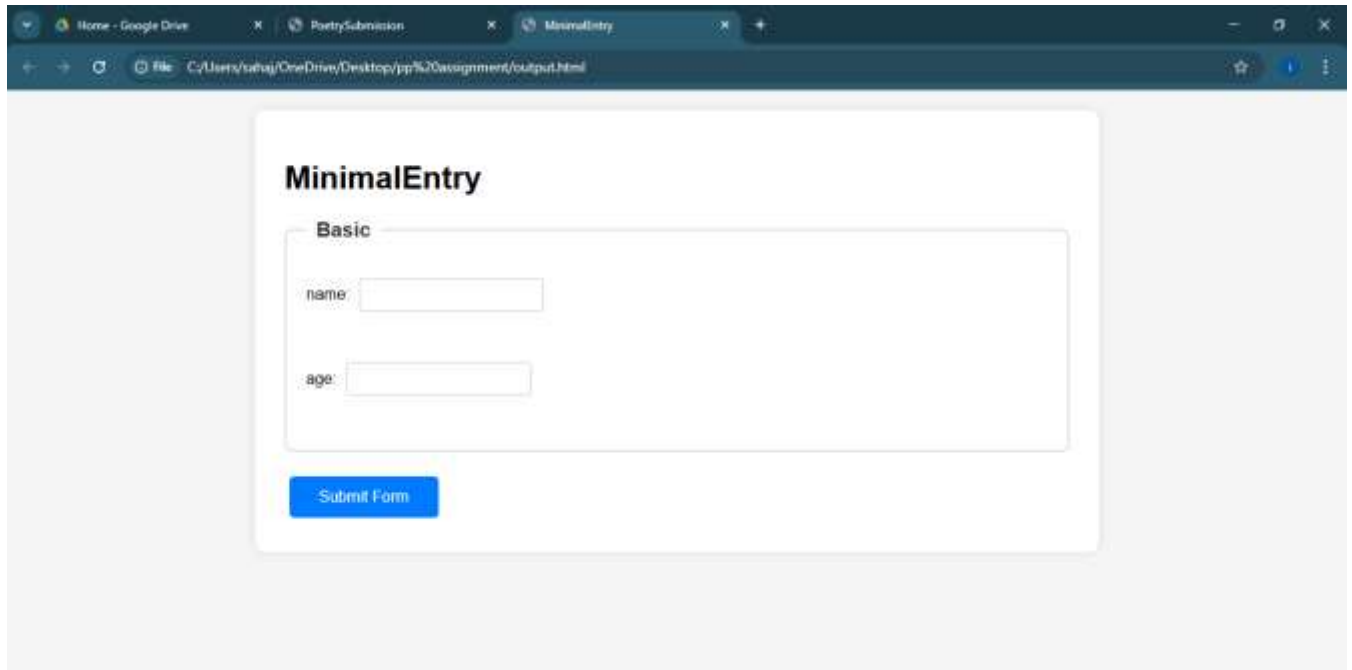
```
form MinimalEntry {  
  section Basic {  
    field name: text;  
    field age: number;  
  }  
}
```

example_minimal output

```
<!DOCTYPE html>  
<html>  
<head>  
<title>MinimalEntry</title>  
<style>  
body { font-family: Arial, sans-serif; margin: 20px; background-color: #f5f5f5; }  
.form-container { max-width: 800px; margin: 0 auto; background: white; padding: 30px; border-radius: 10px; box-shadow: 0 0 10px rgba(0,0,0,0.1); }  
fieldset { margin: 20px 0; padding: 20px; border: 2px solid #ddd; border-radius: 8px; }  
legend { font-weight: bold; font-size: 1.3em; color: #333; padding: 0 10px; }  
label { display: block; margin: 12px 0; font-weight: 500; }  
input, textarea, select { margin: 5px; padding: 8px; border: 1px solid #ccc; border-radius: 4px; font-size: 14px; }  
input[type='submit'] { background-color: #007bff; color: white; padding: 12px 30px; border: none; border-radius: 5px; cursor: pointer; font-size: 16px; }  
input[type='submit']:hover { background-color: #0056b3; }  
.radio-group, .checkbox-group { margin: 10px 0; }  
.radio-group input, .checkbox-group input { margin-right: 8px; }  
.error { color: red; font-size: 0.9em; margin-top: 5px; }  
</style>  
<script>
```



```
function validateForm() {  
    var age = document.forms['MinimalEntry']['age'].value;  
    if (age < 13) {  
        alert('Contestants must be at least 13 years old to participate.');        return false;  
    }  
    if (age > 99) {  
        alert('Invalid age provided.');        return false;  
    }  
    return true;  
}  
</script>  
</head>  
<body>  
<div class='form-container'>  
<form name="MinimalEntry" method="post" onsubmit="return validateForm()">  
<h1>MinimalEntry</h1>  
<fieldset>  
<legend>Basic</legend>  
<label>name: <input type="text" name="name" ></label><br>  
<label>age: <input type="number" name="age" ></label><br>  
</fieldset>  
<input type="submit" value="Submit Form">  
</form>  
</div>  
</body>  
</html>
```



3.

example_custom_validation input

```
form AgeGate {  
  section Info {  
    field username: text required;  
    field age: number required min=12 max=120;  
  }  
  
  validate {  
    if (age < 18) {  
      error "You must be 18+."  
    }  
  }  
}
```

example_custom_validation output

```
<!DOCTYPE html>  
<html>
```

```

<head>

<title>AgeGate</title>

<style>

body { font-family: Arial, sans-serif; margin: 20px; background-color: #f5f5f5; }

.form-container { max-width: 800px; margin: 0 auto; background: white; padding: 30px; border-
radius: 10px; box-shadow: 0 0 10px rgba(0,0,0,0.1); }

fieldset { margin: 20px 0; padding: 20px; border: 2px solid #ddd; border-radius: 8px; }

legend { font-weight: bold; font-size: 1.3em; color: #333; padding: 0 10px; }

label { display: block; margin: 12px 0; font-weight: 500; }

input, textarea, select { margin: 5px; padding: 8px; border: 1px solid #ccc; border-radius: 4px;
font-size: 14px; }

input[type='submit'] { background-color: #007bff; color: white; padding: 12px 30px; border:
none; border-radius: 5px; cursor: pointer; font-size: 16px; }

input[type='submit']:hover { background-color: #0056b3; }

.radio-group, .checkbox-group { margin: 10px 0; }

.radio-group input, .checkbox-group input { margin-right: 8px; }

.error { color: red; font-size: 0.9em; margin-top: 5px; }

</style>

<script>

function validateForm() {

    var age = document.forms['AgeGate']['age'].value;

    if (age < 13) {

        alert('Contestants must be at least 13 years old to participate.');
        return false;

    }

    if (age > 99) {

        alert('Invalid age provided.');
        return false;

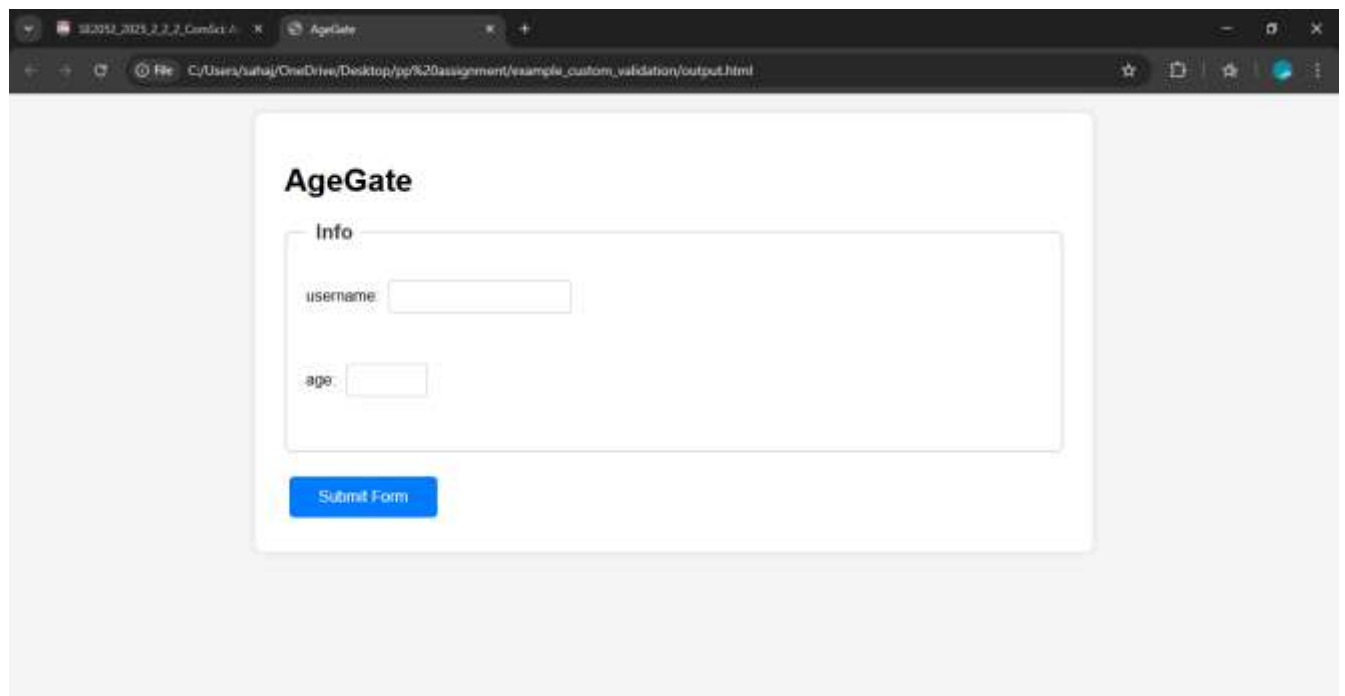
    }

    return true;

}

```

```
</script>
</head>
<body>
<div class='form-container'>
<form name="AgeGate" method="post" onsubmit="return validateForm()">
<h1>AgeGate</h1>
<fieldset>
<legend>Info</legend>
<label>username: <input type="text" name="username" required></label><br>
<label>age: <input type="number" name="age" required min="12" max="120"></label><br>
</fieldset>
<!-- Validation: You must be 18+. -->
<input type="submit" value="Submit Form">
</form>
</div>
</body>
</html>
```

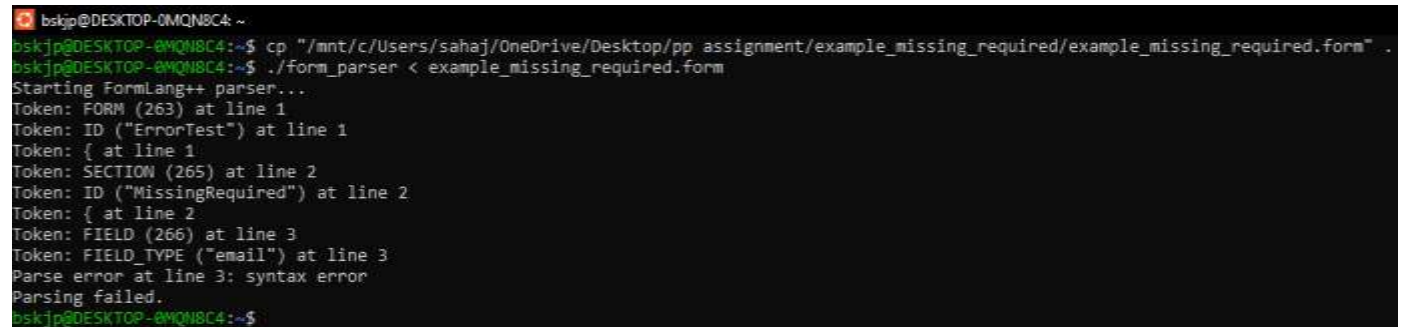


The screenshot shows a web browser window with the title "AgeGate". The address bar displays the file path: "C:\Users\safaj\OneDrive\Desktop\pg%20assignment\example_custom_validation\output.html". The form itself is titled "AgeGate" and contains a legend titled "Info". Inside the legend, there are two input fields: "username" (a text input) and "age" (a number input). Below the legend, there is a blue button labeled "Submit Form".

4.

example_missing_required input

```
form ErrorTest {  
    section MissingRequired {  
        field email: email;  
        field poem: textarea;  
    }  
  
    validate {  
        if (age < 18) {  
            error "Too young."  
        }  
    }  
}
```



```
bskjp@DESKTOP-0MQN8C4: ~  
bskjp@DESKTOP-0MQN8C4:~$ cp "/mnt/c/Users/sahaj/OneDrive/Desktop/pp_assignment/example_missing_required/example_missing_required.form" .  
bskjp@DESKTOP-0MQN8C4:~$ ./form_parser < example_missing_required.form  
Starting FormLang++ parser...  
Token: FORM (263) at line 1  
Token: ID ("ErrorTest") at line 1  
Token: { at line 1  
Token: SECTION (265) at line 2  
Token: ID ("MissingRequired") at line 2  
Token: { at line 2  
Token: FIELD (266) at line 3  
Token: FIELD_TYPE ("email") at line 3  
Parse error at line 3: syntax error  
Parsing failed.  
bskjp@DESKTOP-0MQN8C4:~$
```