

## Assignment 5

### Top-Down Parsing

1. Consider the following context-free grammar

$$A \rightarrow B C \mid D e$$
$$B \rightarrow a B \mid b \mid \epsilon$$
$$C \rightarrow c C d \mid \epsilon$$
$$D \rightarrow d D \mid \epsilon$$

where A is the start symbol.

(a) (30%) Compute First sets and Follow sets for the nonterminals in the grammar.

$$\text{First}(A) : \{a, b, c, d, e, \epsilon\}$$
$$\text{First}(B) : \{a, b, \epsilon\}$$
$$\text{First}(C) : \{c, \epsilon\}$$
$$\text{First}(D) : \{d, \epsilon\}$$
$$\text{Follow}(A) : \{\$ \}$$
$$\text{Follow}(B) : \{c, \$ \}$$
$$\text{Follow}(C) : \{d, \$ \}$$
$$\text{Follow}(D) : \{e\}$$

(b) (40%) Construct the procedures of the recursive-decent parser for the grammar.

```
const int e = 1, a = 2, b = 3, c = 4, d = 5;
```

```
int token = lexer();
```

```
void match(int t)
```

```
{
```

```
    if (token == t)
```

```
    {
```

```
        token = lexer();
```

```
    }
```

```
    else {
```

```
        error();
```

```

    }
}

void A(){
    switch(token){
        case a:
        case b:
        case c:
        case $:
            B();C();
            break;
        case d:
        case e:
            D();match(e);
            break;
        default:
            error();
    }
}

```

```

void B(){
    switch(token){
        case a:
            match(a);B();
            break;
        case b:
            match(b);
            break;
        case c:
        case $:
            break;
        default:
            error();
    }
}

```

```
void C(){
    switch(token){
        case c:
            match(c);C();match(d);
            break;
        case d:
        case $:
            break;
        default:
            error();
    }
}
```

```
void D(){
    switch(token){
        case d:
            match(d);D();
            break;
        case e:
            break;
        default:
            error();
    }
}
```

(c) (30%) Construct the parsing table of the table-driven predictive parser for the grammar.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>a</b>	$A \rightarrow BC$	$B \rightarrow aB$		
<b>b</b>	$A \rightarrow BC$	$B \rightarrow b$		
<b>c</b>	$A \rightarrow BC$	$B \rightarrow \epsilon$	$C \rightarrow cCd$	
<b>d</b>	$A \rightarrow De$		$C \rightarrow \epsilon$	$D \rightarrow dD$
<b>e</b>	$A \rightarrow De$			$D \rightarrow \epsilon$
<b>\$</b>	$A \rightarrow BC$	$B \rightarrow \epsilon$	$C \rightarrow \epsilon$	