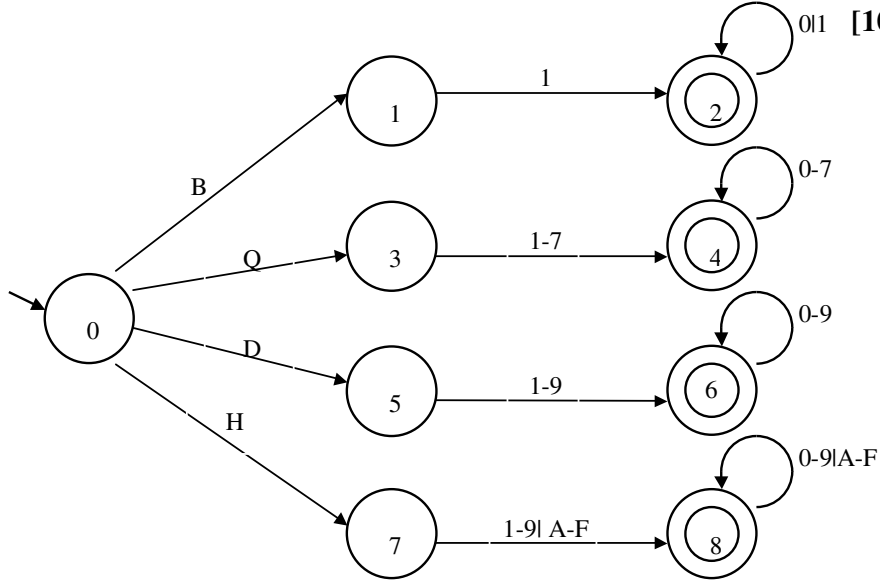


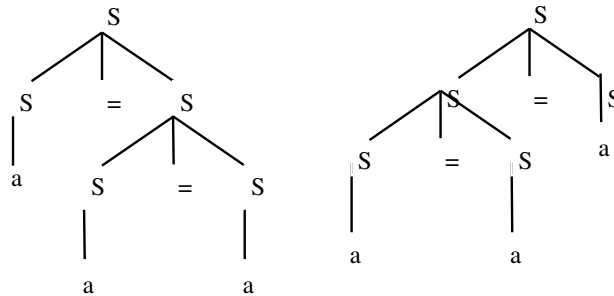
CA448 Compiler Construction 1 Repeat Examination Answers 2007

1. $B1(01)^* \mid Q(1-7)(0-7)^* \mid D(1-9)(0-9)^* \mid H(1-9|A-F)(0-9|A-F)^*$ [10 marks]

2. [10 marks]



3. The following parse trees can be derived for the given sentence $a = a = a$: [10 marks]



Therefore the grammar is ambiguous.

4. $LOOKAHEAD(S \rightarrow BA) = (FIRST(B) - \{\epsilon\}) \cup FIRST(A)$ [10 marks]

$$= \{a\} \cup \{b,c\} = \{a,b,c\}$$

$$LOOKAHEAD(S \rightarrow c) = FIRST(c)$$

$$= \{c\}$$

$$LOOKAHEAD(A \rightarrow bB) = FIRST(b)$$

$$= \{b\}$$

$$LOOKAHEAD(A \rightarrow cB) = FIRST(c)$$

$$= \{c\}$$

$$LOOKAHEAD(B \rightarrow a) = FIRST(a)$$

$$= \{a\}$$

$$LOOKAHEAD(B \rightarrow \epsilon) = (FIRST(\epsilon) - \{\epsilon\}) \cup FOLLOW(B)$$

$$= \{\} \cup \{b,c,\$ \} = \{b,c,\$ \}$$

The grammar is not LL(1) since c predicts both $S \rightarrow BA$ and $S \rightarrow c$

5. The converted grammar is as follows:

[10 marks]

$A \rightarrow xBA'$
 $A' \rightarrow CyA'$
 $A' \rightarrow \varepsilon$
 $B \rightarrow y$
 $C \rightarrow yC'$
 $C' \rightarrow x$
 $C' \rightarrow \varepsilon$

6. The following LR(0) items are produced for this grammar:

[10 marks]

1: $S \rightarrow \bullet E\$$
 $E \rightarrow \bullet id$
 $E \rightarrow \bullet id(E)$
 $E \rightarrow \bullet E+id$
2: $S \rightarrow E \bullet \$$
 $E \rightarrow E \bullet +id$
3: $S \rightarrow E\$ \bullet$
4: $E \rightarrow E+ \bullet id$
5: $E \rightarrow E+id \bullet$
6: $E \rightarrow id \bullet$
 $E \rightarrow id \bullet (E)$
7: $E \rightarrow id(\bullet E)$
 $E \rightarrow \bullet id$
 $E \rightarrow \bullet id(E)$
 $E \rightarrow \bullet E+id$
8: $E \rightarrow id(E \bullet)$
 $E \rightarrow E \bullet +id$
9: $E \rightarrow id(E) \bullet$

There is a shift-reduce conflict in state 6, so the grammar is not LR(0).

7. The following LR(1) items are produced for this grammar:

[10 marks]

1: $S \rightarrow \bullet Aa, \$$
 $S \rightarrow \bullet Bb, \$$
 $S \rightarrow \bullet cC, \$$
 $A \rightarrow \bullet D, a$
 $B \rightarrow \bullet D, b$
 $D \rightarrow \bullet, a$
 $D \rightarrow \bullet, b$
2: $S \rightarrow A \bullet a, \$$
3: $S \rightarrow B \bullet b, \$$
4: $S \rightarrow c \bullet C, \$$
 $C \rightarrow \bullet Ab, \$$
 $C \rightarrow \bullet Ba, \$$
 $A \rightarrow \bullet D, b$
 $B \rightarrow \bullet D, a$

- D → ●, b
- D → ●, a
- 5: A → D●, a
- B → D●, b
- 6: S → Aa●, \$
- 7: S → Bb●, \$
- 8: S → cC●, \$
- 9: C → A●b, \$
- 10: C → B●a, \$
- 11: A → D●, b
- B → D●, a
- 12: C → Ab●, \$
- 13: C → Ba●, \$

There are no shift-reduce conflicts, so the grammar is LR(1).

8. Merging states 5 and 11 results in a reduce-reduce conflict, so the grammar is not LALR(1). [10 marks]

9. The attribute grammar is as follows: [10 marks]

Literal → IntPart . FracPart	Literal.value := IntPart.value + Fracpart.value
IntPart ₁ → IntPart ₂ Digit	IntPart ₁ .value := IntPart ₂ .value * 10 + Digit.value
IntPart → Digit	IntPart.value := Digit.value
FracPart ₁ → Digit FracPart ₂	FracPart ₁ .value := (FracPart ₂ .value + Digit.value)/10
FracPart → Digit	FracPart.value := Digit.value/10

10. The directed acyclic graph is as follows: [10 marks]

