St. Name: St. Number:

Section: Seat number:

Q1) Consider the following pseudocode for a recursive descent parser.

```
function parseA()
  if lookahead == 'a'
    match('a')
    parseA()
    parseB()
  else if lookahead == 'b'
    match('b')

function parseB()
  match('b')

function match(token)
  if lookahead == token
    consume()
  else
    error("Unexpected token")
```

a) Give an example of a string of at least two characters that the above parser would accept. (2 grades)

abb   *aaaaabb*

b) Give an example of a string of at least two characters that the above parser would reject. (2 grades)

aba   or   *aab*   etc...

c) Write down the corresponding Context-Free grammar for the language of the parser. (3 grades)

$A \rightarrow aAB \mid b$

$B \rightarrow b$

Q2) Consider the partial LL(1) table, note that some entries in the table are unknown.

	a	b	c	f	g	h	$
S	One unknown production						
B			cC				
C		b		ε	ε	ε	
D				EF	EF	EF	
E				ε	g	ε	
F				f		ε	

a) What is the first set of S? (2 grades)

$first(S) = \{a\}$

b) What is the follow set of D? (2 grades)

$follow(D) = \{ \text{~~~~} h\}$

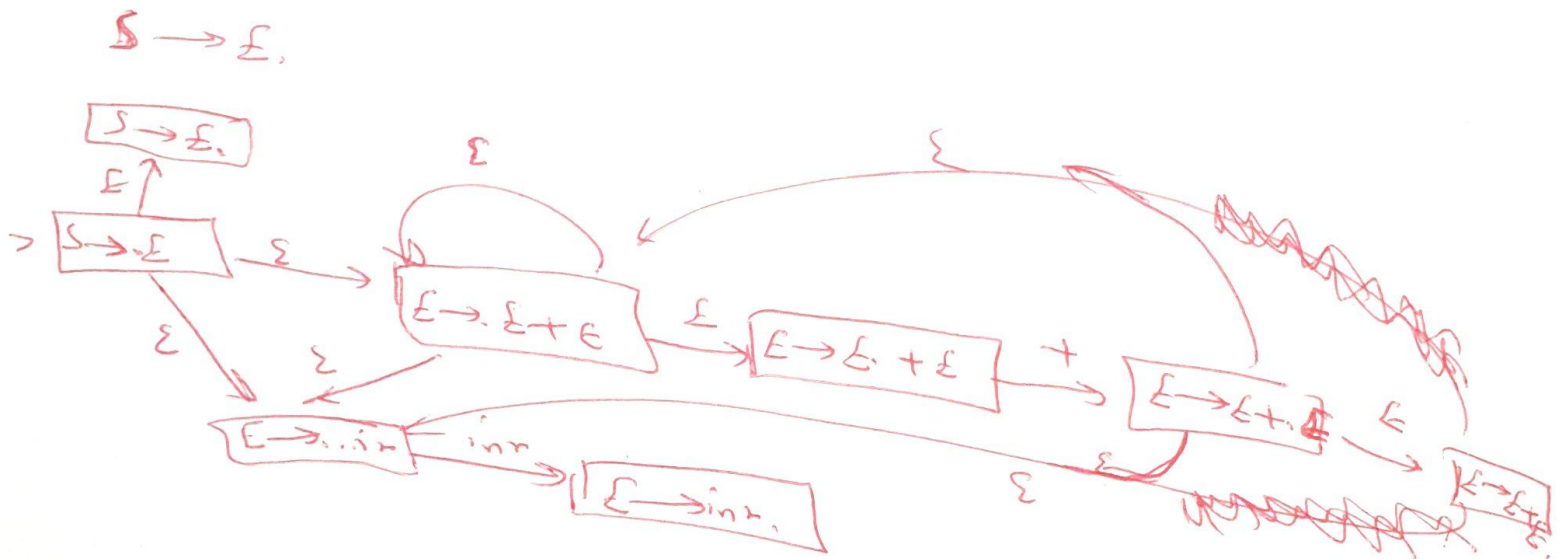c) What are the production(s) for the nonterminal C (2 grades)

$C \longrightarrow b \mid \varepsilon$

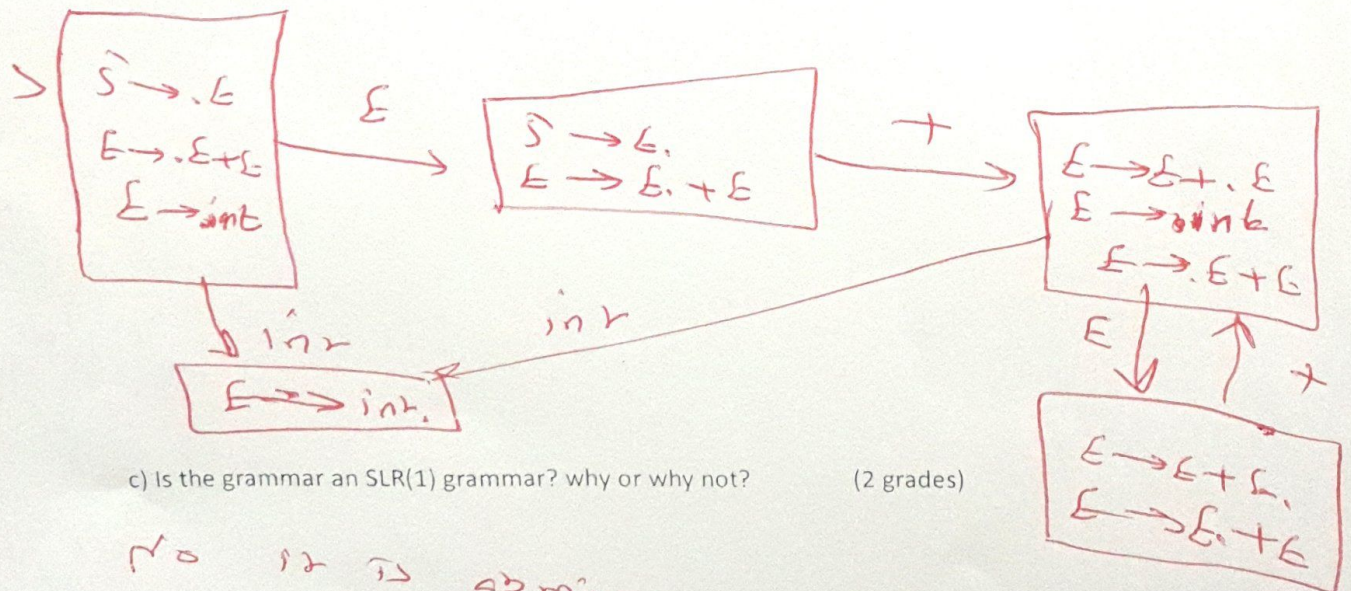d) Complete this production for S (fill in the missing parts marked using '?'). (4 grades)

S→ ?B?h

$S \rightarrow a B D h$

because because because follow (D)

The first $

Q3) Consider the grammar E→E+E|int

a) Construct an NFA that determines the viable prefixes.   (3 grades)

b) Convert the NFA to a DFA.   (3 grades)

c) Is the grammar an SLR(1) grammar? why or why not?   (2 grades)

No it is ambiguous

Q4) Given the following inference rule

$\vdash e1 : T$
$\vdash e2 : T$

$\vdash e1 = e2 : T$

a) Write a similar rule that works for reference types.   (2 grades)

$$\vdash e_1 : T_1$$
$$\vdash e_2 : T_2$$
$$T_2 \subseteq T_1$$
$$\overline{\qquad\qquad\qquad}$$
$$\vdash e_1 = e_2 : T_1$$

b) Suggest a minimal modification to the type system that would allow us to assign an integer constant to a variable of type char, and a character, e.g., 'A', to a variable of type int.   (4 grades).

$$char \subseteq int$$

&

$$int \subseteq char$$