



JK Lakshmipat University Jaipur

BTech - VI Semester
Computer Science and Engineering
Compiler Design CS1112
Final Exam

Time: 2 hours

29 Apr 2024

Max Marks: 30

Instructions

- Write your roll number here : _____
- **ANY OTHER MARKING OF ANY KIND ON YOUR QUESTION PAPER WILL BE CONSIDERED CHEATING AND GIVE YOU A STRAIGHT ZERO. So do your rough-work in the answer-sheet itself.**
- Irrelevant answers may lead to loss of marks.

1) With reference to translation of conditional statements to three-address codes as discussed in the class, what are the attributes assigned to boolean expressions. Explain their meanings.

1.5 marks [CO1,2]

2)

- a) Write the difference between synthesised and inherited attributes in syntax directed definitions (SDDs).
b) What is an S-attributed SDD?

1 + 0.5 = 1.5 marks [CO2,5]

3) Consider the following grammar

$S \rightarrow aYa$

$Y \rightarrow bS \mid b$

- a) Is language generated by this grammar regular? Justify your answer.
b) Write the FIRST and FOLLOW for all the non terminals.

1 + 2 = 3 marks [CO2]

4)

a) Draw a picture illustrating the memory layout of an executing program in Linux.

b) Consider the program shown below:

```
#include <stdio.h>
#include <stdlib.h>
int a=200;
void fn1();
void fn2();
int main(){
    int d=10;
    int *e=malloc(sizeof(int));
    printf("In main:\n");
    printf("    Address of a is : %p\n",&a);
    printf("    Address of d is : %p\n",&d);
    printf("    The Address e is : %p\n",e);
    fn1();
}
void fn1(){
    int b=10;
    printf("In fn1:\n");
    printf("    Address of a is : %p\n",&a);
    printf("    Address of b is : %p\n",&b);
    fn2();
}
void fn2(){
    int c=10;
    printf("In fn2:\n");
    printf("    Address of c is : %p\n",&c);
}
```

The output of the program will contain various memory addresses. Assume we ran this on a Linux system where memory addresses are only 16bits long and suppose the addresses which were present in the output were 0x5000, 0x5500, 0x7000, 0x7020 and 0x7048 in some order (one address was repeated). Write the complete output of the program.

In the output, after each memory address write in brackets which memory segment that address belongs to. The memory segments should be from the following list : global / heap / code / stack of main / stack of fn1 / stack of fn2.

2 + 6 = 8 marks [CO1,5]

5) Consider a flex / bison program as shown below:

```

/*-----lexer.l-----*/
%{
#include <stdlib.h>
#include <string.h>
#include "parser.tab.h"
%}
%%
[ \t]+ {}
[A-Z]+ {yyval=strlen(yytext); return WORD;}
[a-z]+ {yyval=0; return WORD;}
\+ {return PLUS;}
\n {return EOL;}
. {printf("Lexer Error: %s\n",yytext);}
%%

/*-----parser.y-----*/
%{
#include <stdio.h>
int yylex();
int yyerror(char* s);
%}
%token WORD
%token PLUS
%token EOL
%%
list:
    | list exp EOL {printf("%d\n",$2);}
;
exp: factor {$$=$1;}
    | exp PLUS factor {$$ = $1 + $3;}
;
factor: WORD {$$=$1;}
    | factor WORD {$$ = $1 * 10 + $2;}
;
%%
int main(){
    yyparse();
}
int yyerror(char* s){
    fprintf(stderr,"error: %s\n",s);
}

```

Consider inputs to the program shown below. For each of these a) write the sequence of tokens generated by the lexer (write the token name and its value if it has got one); b) draw the parse tree and c) write the final value printed by the parser

(i) GOOD LUCK

(ii) STUDY+EXAM IS MARKS + GRADES

(iii) HardWORK

(assume that there is a \n character at the end of each of these).

3 + 4 + 3 = 10 marks [CO3]

6) Answer the following:

- (i) Write the name of a bottom-up parsing method.
- (ii) How many entries can a cell of the predictive parsing table for an LL(1) grammars have? Write all possibilities.
- (iii) Out of the LL(1) parser and the canonical LR(1) parser write which is more powerful?
- (iv) Consider the set of SLR(1) grammars and the set of LR(1) grammars. Draw a Venn diagram depicting these sets.
- (v) We are told that the LR(1), SLR and LALR parsing tables of a grammar have either 100 or 1000 states. From this information tell the number of states in each of these tables.

$1 + 1 + 1 + 1 + 2 = 6$ marks [CO2,5]