SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT

COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

B. Tech-3rd Year End-Semester Examination (EVEN SEM) (2-May-2022)

Subject – SYSTEM SOFTWARE

Time: 12:00 – 3:00 pm **Marks: 50**

1. Attempt any eight. **40 Marks**

A. Consider following assembly code and show output of PASS 2 of two pass assembler with entries in MOT(machine opcode table), ST(symbol table), LT(Literal table), Literal Pool Table and identify AD(Assembler directive), IS(Imperative statements), DS(Declaration statement), Label.

```
          START 200
          MOVER AREG, ='5'
          MOVEM AREG, X
L1        MOVER BREG, ='2'
          ORIGIN L1+3
          LTORG

NEXT      ADD AREG, ='1'
          SUB BREG, ='2'
          BC LT, BACK
          LTORG

          BACK EQU L1
          ORIGIN NEXT+5
          MULT CREG, ='4'
          STOP
          X DS 1
          END
```

B. Consider the following MACRO and show contents of the following data structure.
(1) MNT (2) MDT (3) PNTAB (4) KPDTAB (5) EVNTAB (6) SSNTAB (7) SSTAB
(8) EVTAB (9) APTAB (EVAL A, 10, B, REG=CREG)

```
          MACRO
          EVAL &X, &Y, &Z, &REG=BREG
          LCL &P
&P        SET 5
          MOVER &REG, &X
          SUB &REG, &Y
          ADD &REG, &Z
          AIF (&Y EQ &X)        .ONLY
          AGO .OVER
.ONLY     MOVER &REG, &Z
.OVER     MEND
```

C. Explain the need for relocation of a program. Consider the following Assembly language program and show contents of the following data structure. (1) Object module header (2) RELOCTAB (3) LINKTAB

```
                Statement                Address    Code
          START  500
          ENTRY  TOTAL
          EXTRN  MAX, ALPHA
          READ   A                       500)   + 09 0 540
LOOP                                     501)
          :
          MOVER  AREG, ALPHA             518)   + 04 1 000
          BC     ANY, MAX                519)   + 06 6 000
          :
          BC     LT, LOOP                538)   + 06 1 501
          STOP                           539)   + 00 0 000
A         DS     1                       540)
TOTAL     DS     1                       541)
          END
```

D. Why is an impure interpreter better than a pure interpreter? What is debugger and explain with its types of error occurring in a program with example.

E. Which two methods are used in lexical analyser for buffering the input. Which technique is used for speeding up the lexical analyser. Justify your answer.

F. Given grammar:-

$a = b * - c + b * - c$

$b * c b * + -$

S -> qABC
A -> a | bbD
B -> a | ∈
C -> b | ∈
D -> c | ∈

(i). Find the FIRST () and FOLLOW () set for the above grammar. Mention appropriate applicable rules for each set you derive. **(2)**
(ii). Construct a predictive parser table. **(2)**
(iii). Justify if the grammar is LL(1) or not. **(1)**

G. What do you understand by a handle? What is handle pruning? Explain stack implementation of shift reduce parser with the help of an example.

H. Consider the following grammar,

S -> AS | b
A -> SA | a

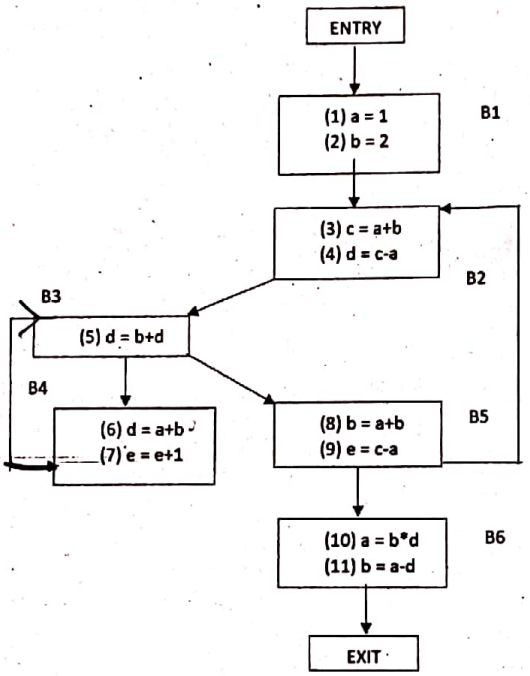
Construct SLR parse table for the grammar. Show the actions of the parser, for the input string **"abab".**

I. What are triples, quadruples and indirect triples? Write the quadruple, triple, indirect triple for the expression below. Show how it will be helpful in code optimization?
a := b * - c + b * - c

J. How are basic blocks and flow graphs useful in code optimization? Write an algorithm to partition three address codes into basic blocks. Write a method to derive flow graphs from a basic block.

2 **Solve the following question.** **10 Marks**

Consider following flow graph



(i) Optimize for any global common subexpression for each loop.
(ii) Optimize for any induction variable for each loop. Be sure to consider any constant.
(iii) Optimize for any loop invariant computations for each loop.
(iv) Optimize for reaching definition analysis for each block.
(v) Compute any available expression for each block.