

MSc in COMPUTER SCIENCE

BASIC PAPER

D0b

QUESTION PAPER

DUMMY COVER

ORIGINAL

EXAMINERS COPY

EXAM Co-ordinator

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2 HOURS 30 MINUTES

ANSWER ALL 3 QUESTIONS

Electronic calculators are not permitted.

Each question carries a mark of 25. The total mark will be scaled to a percentage.

Question 1

Answer BOTH parts (a) AND (b), and EITHER part (c) OR part (d)

a) Answer this part

Explain the term *matching*, as it is used in the context of parsing. Also describe what a *matcher* does. [3 marks]

b) Answer this part

Consider the statement

```
do
    sum = sum + 100;
while (sum < 1000);
```

- i) By reference to this example, explain the terms *lexeme*, *keyword*, *token*, *token type*, *token value*
- ii) Show the kind of code for a simple stack-based machine that might be generated from the example.

[6 marks]

Question 1 continues on next page

Question 1 Continued

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c) Answer either this part or part (d)

- i) Draw a syntax diagram for the *do-while* statement. You may assume that syntax diagrams already exist for *statement* and *expression* (including boolean expressions).
- ii) Add lookaheads to your syntax diagram as necessary
- iii) Add code annotations to your syntax diagram
- iv) Show how your annotated syntax diagram could be translated into a method for a recursive-descent compiler. Explain the nature and purpose of any other methods to which you refer.
- v) Justify that your implementation would work for nested constructs

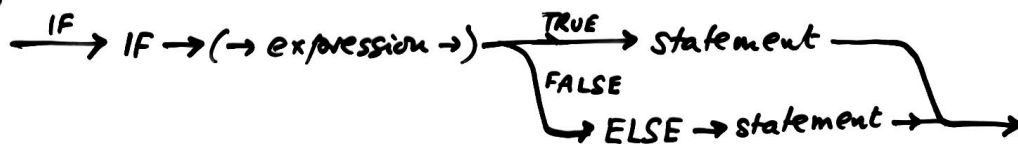
[16 marks]

d) Answer either this part or part (c)

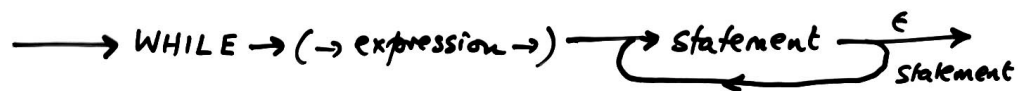
Discuss each of the following syntax diagrams.

[You may wish to comment on issues such as whether they correctly model constructs in Java, whether the lookaheads are appropriate, and whether the diagrams are suitable as a basis for implementation as methods in a recursive-descent compiler.]

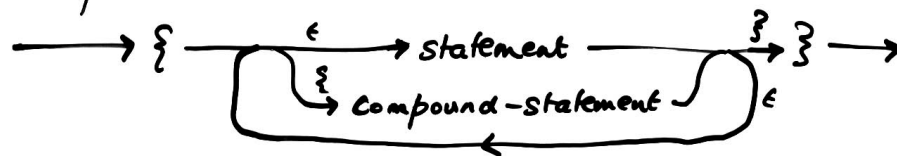
(i) *if-statement*



(ii) *while-statement*



(iii) *Compound-statement*



(iv) *arithmetic-expression*



[16 marks]

END OF QUESTION 1

Question 2 continues on next page

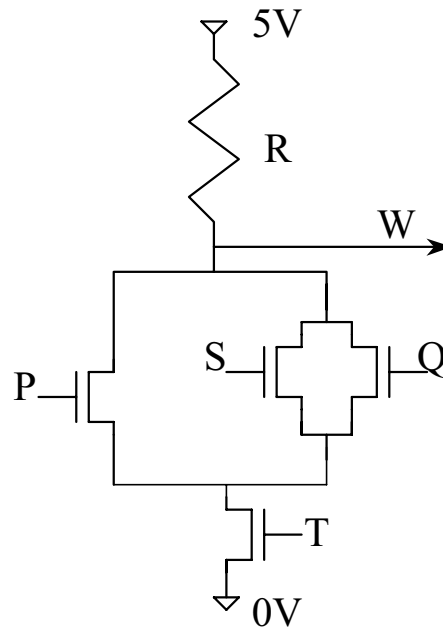
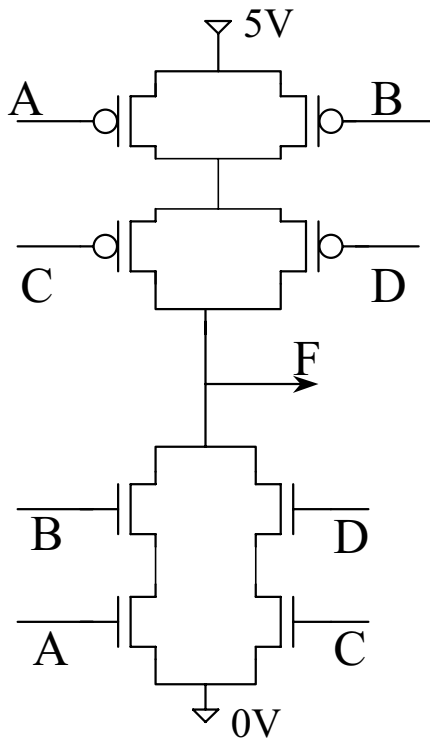
**END OF QUESTION 2
CONTINUED**

Question 3

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Answer any 3 parts from parts (a)-(f):

(a) Use truth tables and Karnaugh maps or other means to derive the logical function performed by both the following circuits:-



[8 Marks]

(b) What is the role of transistors in digital electronic circuits? [1 Mark]

Explain the difference between a p-type and n-type semi-conducting material, and explain the action of a *p-n junction*. [2 Marks]

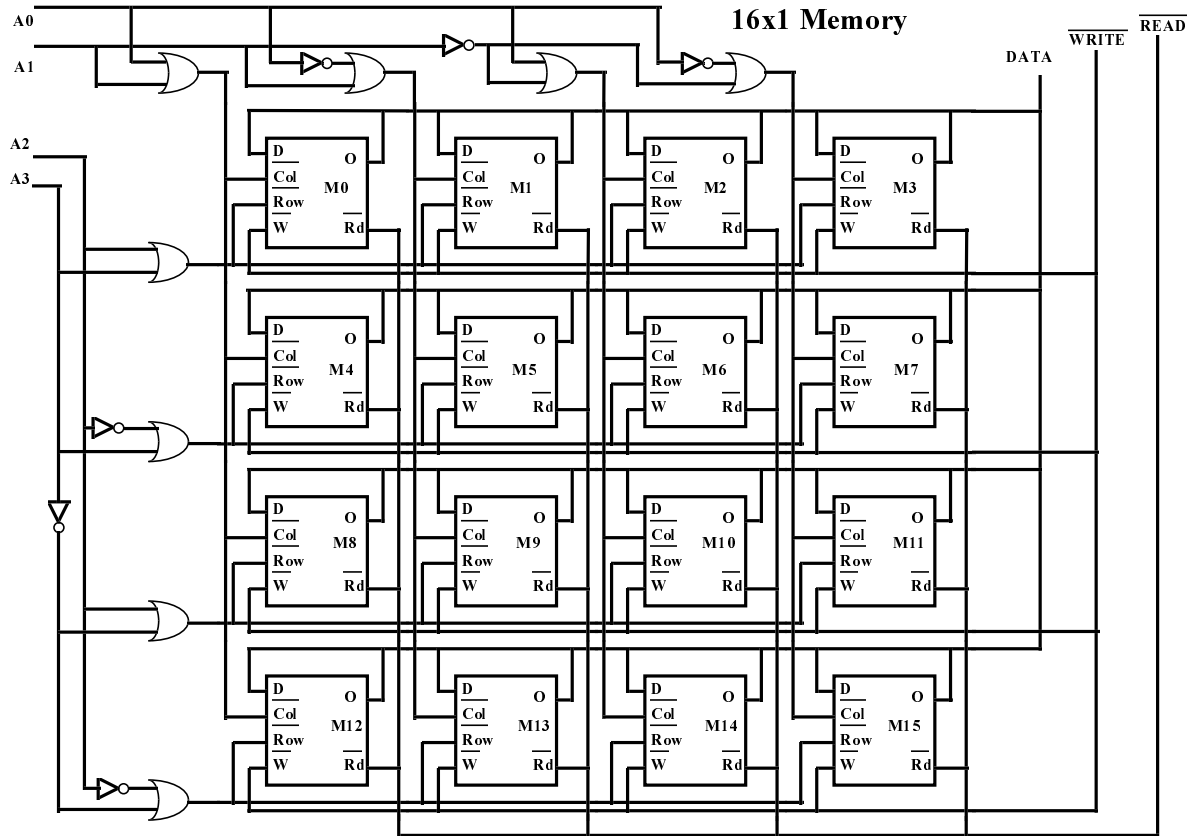
Draw a diagram of an MOS n-transistor and briefly explain its operation. [5 Marks]

(c) Outline the structure and operation of Finite State Machines as used in digital electronic circuits and explain why they are useful. [8 Marks]

QUESTION 3 CONTINUES ON NEXT PAGE

(d) Explain the structure and operation of the memory in the diagram below.

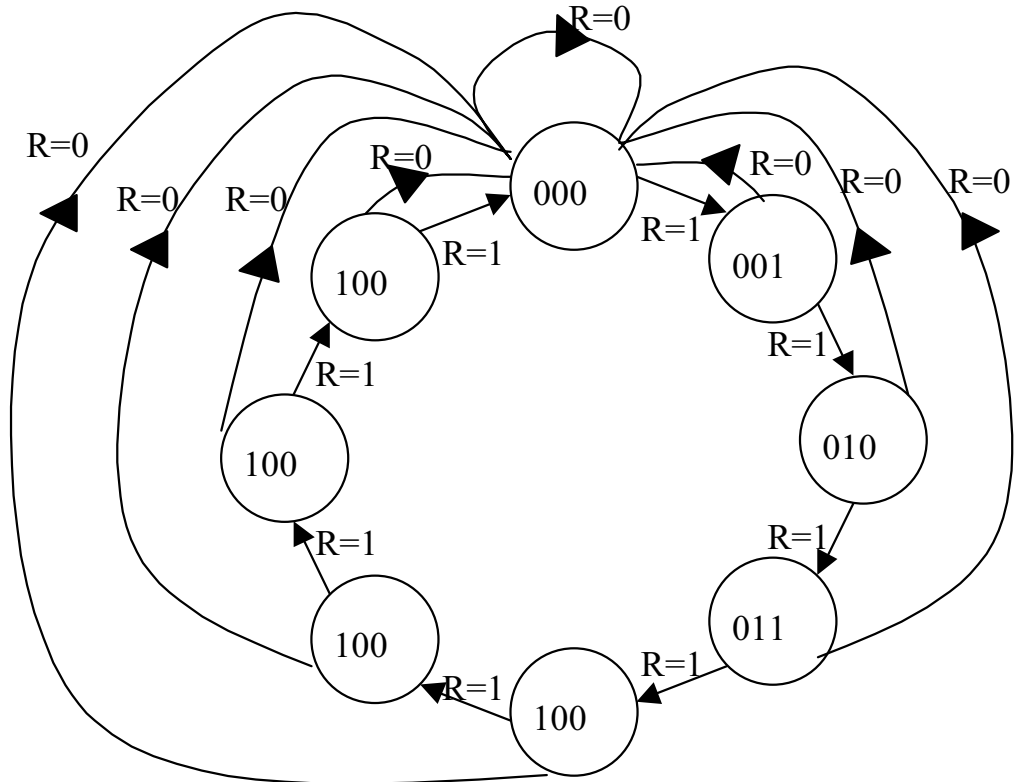
Each 1-bit memory cell has a tri-state buffer on its output. What is a tri-state buffer and why is it required?



[8 Marks]

QUESTION 3 CONTINUES ON NEXT PAGE

(e) Draw the truth table for the Finite State Machine (FSM) with the following State Diagram:

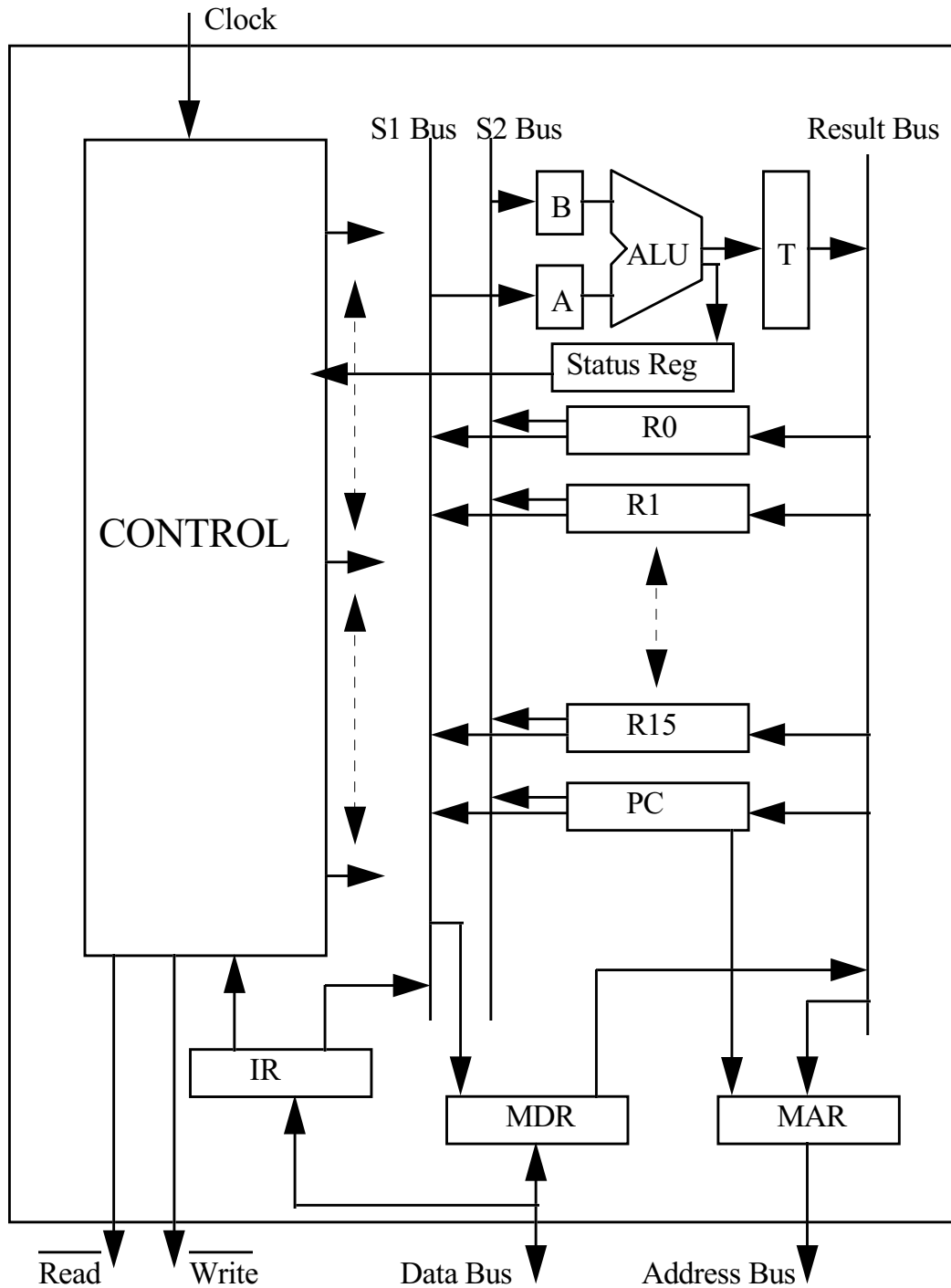


Use Karnaugh maps or another technique to derive the equations for the next state bits.

Draw the final circuit for the finite state machine using AND, OR and INVERTER gates and flip-flops for the state store. [8 Marks]

QUESTION 3 CONTINUES ON NEXT PAGE

- (f) With regard to the CPU in the figure below, describe the sequence of events that occur from when the CPU moves into its instruction fetch phase until the end of the execution phase of the instruction that is fetched, assuming that the instruction fetched adds the content of register *r1* to register *r15*. [8 Marks]



END OF QUESTION 3