

1. Match each of the assertions and reason you consider to be the best justification. (20%, 4% each)

1A. ASSERTIONS

- a) The use syntax diagrams to define the PASCAL language is important because
- b) A PASCAL procedure may call it self because
- c) A computer must be programmed because
- d) Allowing a PASCAL function to assign values to non-local variables is poor programming practice because

REASONS

- s) It consists of a finite number of characters and symbols
- r) It is within its own scope
- t) It describes the language in a precise and concise form
- u) It executes programs quickly
- v) It can only perform simple tasks directly
- w) It may cause that the result is not undefined
- x) It may cause side effect

1B. ASSERTIONS

- a) Sequence can be represented in Jackson diagram because
- b) Iteration can be represented in a Jackson diagram because
- c) Jackson diagrams may be difficult to read because
- d) Jackson diagrams can be translated directly in PASCAL programs because

REASONS

- r) Common structures can be identified
- s) Boxes containing an '*' (asterisk) denote this
- t) They may be large and monolithic
- u) It represents the root of the grammar
- v) Boxes placed horizontally denote this construct
- w) It denotes an alternative
- x) It represents an iteration

1C. ASSERTIONS

- a) WHILE i:=1 DO something; is incorrect PASCAL because
- b) FOR i:=1 DOWN TO 10 DO something; is incorrect PASCAL because
- c) IF day = 'MONDAY' THEN day_number:=1
ELSE day_number:='m' is incorrect PASCAL because
- d) Indentation of compound statements is useful because

REASONS

- r) Of layout convention
- s) Of type incompatibility
- t) It is ambiguous
- u) The controlling expression is invalid
- v) A reserved word is invalid
- w) Compound statements are then more visible
- x) Compound statement allows the grouping of more than one statement

1D. ASSERTIONS

- a) Sequence can be represented in a syntax graph because
- b) Syntax graphs and finite state machines are related because
- c) A finite state transition diagram containing a state with no outgoing arrows is significant because
- d) The form of a syntax graph which can be turned directly into an equivalent finite state transition diagram is significant because

REASONS

- r) Terminal and non-terminal symbols connected by "::-=" denote this
- s) These concrete representations can express the same information
- t) Terminal and non-terminal symbols separated by a non-cyclic arrows line denote this
- u) There must only be terminal symbols present
- v) These are spontaneous transitions
- w) These can be identified as final states
- x) The machine will be deterministic and contain no ambiguity

1E. ASSERTIONS

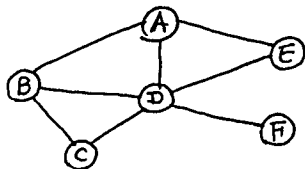
- a) Using stepwise refinement, actions must be composed together because
- b) A top-down approach to design is useful because
- c) Recursive descent is related to data driven design because
- d) Stepwise refinement is a systematic software development method because

REASONS

- r) The term describes the nature of all results that are produced
- s) Detailed decisions can be deferred
- t) Detailed decisions can taken immediately
- u) It must be defined by a grammar
- v) The former is a more powerful version of the same technique as the latter
- w) It helps to reduce the number of 'bugs'
- x) It may be necessary to represent composite actions

2. Explain the following terminologies: (20%)

- a) Pipelining
 - b) Relocation
 - c) Communication protocol
 - d) Distributed computation
 - e) Relational database
3. a) Describe the topologies of a local area network. (5%)
b) How to convert an analog signal into the corresponding digital signal? (5%)
4. Describe three different data structures to represent a graph and explain your answers by the following graph. (10%)



5. Write an algorithm(or program) to recognize which character is an alphabet(A-Z or a-z), which is not from a given character string with length N. (10%)
6. Describe three methods of representing signed binary numbers using appropriate examples. Discuss the effect of the choice of number representation on the design of hardware for addition, subtraction and multiplication. (10%)

7. The two PASCAL procedures shown below were executed on a demand paged machine which has 256 Kbytes of main memory, organized as 512 pages of 512 bytes each. Over a number of runs, it was found that the procedure "sumrows" took, on average, 20 seconds of elapsed time to execute, whereas "sumcolumns" took 500 seconds of elapsed time. Explain how this large difference arises, and show how the procedure "sumcolumns" may be "re-arranged" to deal with this problem. (10%)

```
PROCEDURE sumrows(VAR x : ARRAY[0..511, 0..511] OF byte;  
                  VAR rsum : ARRAY[0..511] OF byte);
```

```
(* This procedure sums the rows of array "x" and *)  
(* places the result in an array, "rsum".      *)
```

```
VAR i, j : INTEGER;  
BEGIN  
FOR i := 0 TO 511 DO  
  BEGIN  
  rsum[i] := 0;  
  FOR j := 0 TO 511 DO  
    rsum[i] := rsum[i] + x[i, j];  
  END;  
END;
```

```
PROCEDURE sumcolumns(VAR x:ARRAY[0..511, 0..511] OF byte;  
                     VAR csum: ARRAY[0..511] OF byte);
```

```
(* This procedure sums the columns of array "x" and *)  
(* places the result in an array, "csum".          *)
```

```
VAR i, j : INTEGER;  
BEGIN  
FOR j := 0 TO 511 DO  
  BEGIN  
  csum[j] := 0;  
  FOR i:=0 TO 511 DO  
    csum[j] := csum[j] + x[i, j];  
  END;  
END;
```

8. Describe the semantics of the "call by reference" parameter passing mechanism. (5%)

In PASCAL, is

```
    WHILE E DO C ;
```

equivalent to an invocation of the following procedure?

```
PROCEDURE whiledo (e:boolean; PROCEDURE c);  
BEGIN  
  IF e THEN  
    BEGIN c; whiledo(e , c) END;  
END;
```

Why or why not? (5%)