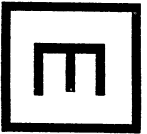


Professor: Joe Culberson

CMPUT 115(Pascal) Section A2  
MIDTERM TWO Oct. 30, 2000  
CLOSED BOOK. NO Notes or Calculators.  
Time 50 minutes.  
Answer all questions in space provided  
Do scratch work on page backs



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CMPUT 115 (A2)  
CULBERSON, J.  
OCT 00 MIDTERM  
PAGES: 6

Last Name: \_\_\_\_\_

First Name: \_\_\_\_\_

Make sure your name and ID is on the top of each internal page

**Question 1 Marks 3** Consider the orders of magnitude  $n, n \log n, n^2, n^3, \dots, n^{100}, 2^n, 3^n \dots 100^n$ . Which is the best  $O$  notation to describe each of the following computing times?

1.a  $T(n) = n^3 + 1000n \log n + 100000$

1.b  $T(n) = n^{89} + 2^n + 10$

1.c  $T(n) = \frac{n^2-1}{n+1} + 10$

**Question 2 Marks 3** Analyze the running time of the following program, expressing your answer using big  $O$  notation.  $A$ ,  $B$  and  $C$  are  $n$  by  $n$  integer matrices. Indicate how you obtain your answer for full marks.

```
for i := 1 to n do
  for j:= 1 to n do
    begin
      C[i,j] := 0;
      for k := 1 to n do
        C[i,j] := C[i,j] + A[i,k] * B[k,j]
      end (* for k *)
    end
  end
end
```

**Question 3 Marks 4** Consider the following Pascal code. (This code is correct.)

```
Program test;
uses WinCrt;

type mrec = record
    x,y :integer;
    end;
    mya = array[1..5] of mrec;
    ptoa = ^mya;

var p : ptoa;

begin
    new(p);
```

3.a [2 marks] Draw a diagram showing the structure that results from the new(p) statement.

3.b [2 marks] Write one line of Pascal code that would assign the value 7 to field x of element 5 of the array pointed to by p. Be careful; this will be marked as either 0 or 2.

**Question 4 Marks 4**

A Pascal program to brighten your day :-)

```
Program GrinIdiot;
USES WinCrt;

var n :integer;

procedure PrintSmiley(n:integer);
begin
    if (n=0) then
        writeln('::-)')
    else begin
        PrintSmiley(n-1);
        PrintSmiley(n-1);
        PrintSmiley(n-1);
    end;
end;

begin
    Readln(n);
    PrintSmiley(n);
end.
```

4.a Draw the recursion tree for this program with input  $n = 2$ .

4.b How many 'smiley's would be drawn if input is  $n = 3$ ?

4.c Give the running time of this program using the big  $O$  notation.

**Question 5 Marks 6** You are to complete the following routine which is to replace the LinkNode following the LinkNode pointed to by `prev` with the LinkNode pointed to by `node`. If `prev` is NIL then replace the first node of the list `L`. Do not create a memory leak.

You do not need to do error checks; you can assume that the LinkNode to be replaced does exist.

```
type LinkPtr = ^LinkNode;
   LinkNode = record
       data : datatype;
       next : LinkPtr;
   end;
   ListType = LinkPtr;

procedure replace(var L:ListPtr; prev : LinkPtr; node :LinkPtr);
```

5.a Draw diagrams showing exactly what you must do.

5.b Write the code to complete the procedure `replace`. Do not use calls to subroutines, except for calls to `get` or `dispose` of memory if needed. You are not allowed to simply copy the data. I want to see that you know how to manipulate pointers correctly.

Question	Mark	Out Of
1	_____	3
2	_____	3
3	_____	4
4	_____	4
5	_____	6
<hr/>		
<b>Total</b>	_____	<b>20</b>