Midterm #2
21 November, 1991

This is an open book exam. You are to turn in this exam at 7:45 PM. (Not 8:30 PM!)

Name: ____________________________________

Use the following type definitions throughout this exam:

TYPE
SINS = (Pride, Lust, Envy, Anger, Sloth) ;
FAULTS = SET OF SINS ;
STR9 = ARRAY[1..9] OF CHAR ;
VEC3 = ARRAY[1..3] OF INTEGER ;
MAT3 = ARRAY[1..3] OF VEC3 ;

Problem 1: 36 points

Starting with the following two declarations

VAR
S: SINS;
F: FAULTS;
V: VEC3;
M: MAT3;

For each of the following 24 expressions, state which of the expressions are valid and give the type of the valid expressions.

\[
\begin{align*}
S + \text{Pride} & \quad S < \text{Lust} \\
F + \text{Pride} & \quad F + [\text{Pride, Lust}] \\
S + 3 & \quad \text{Ord}(S) \\
\text{Ord}(V[2]) & \quad V[1][1] \\
M[S][1] & \quad F \ \text{in} \ S \\
F - [S] & \quad F \ * \ [S] \\
\text{Ord}(M[2]) & \quad V[1] \ \text{DIV} \ (V[2] / V[3]) \\
\text{Succ}(V[3]) & \quad \text{Odd}(S) \\
V[\text{Ord}'B' - \text{Ord}'A'] & \quad V[1/1] \\
\text{EOF}(V) & \quad \text{Chr}(\text{Ord}(S)) \\
V[\text{Trunc}(V[1]/V[2])] & \quad V[\text{Trunc}(V[1]*V[2])] \\
\end{align*}
\]
Use your own paper for these four questions.

**Problem 2: 16 points**

Write a procedure that takes an *unsorted* array of nine characters, declared as a STR9, and returns true if and only if the character 'I' appears twice in the array. Start with the header:

```pascal
FUNCTION I2(S: STR9): BOOLEAN;
```

**Problem 3: 16 points.**

Write a function that takes a three by three two-dimensional array of integers, declared as a MAT3, and returns the sum of adding all nine integers in the three by three array. Start with:

```pascal
FUNCTION MatSum(M: MAT3): INTEGER;
```

**Problem 4: 16 points**

What is the output of the following program

```pascal
PROGRAM MatPrint(INPUT, OUTPUT) ;
VAR
  V: VEC3 ;
  M: MAT3 ;
  I, J: INTEGER ;
BEGIN
  FOR I := 1 TO 3 DO
    V[I] := 5 + I;
  FOR I := 1 TO 3 DO
    BEGIN
      M[I] := V;
      V[I] := V[I] + 10
    END ;
  FOR I := 1 TO 3 DO
    FOR J := 1 TO 3 DO
      WRITE(OUTPUT, M[I][J]:4)
END.
```

**Problem 5: 16 points.**

The *Cheap Skate* company has the following travel rules:

1. You can't spend more than $50 for food in any day.
2. You can't average more than $40 per day in food on a 3 day or longer trip.
3. You must eat exactly three meals per day.
4. You can't average more than $7 per day for breakfast.

Describe how you would write a program to read meal costs from a terminal and see if these rules are obeyed. Describe at least *three* procedures you'd use to solve this problem.

You don't have to write any code. Just give a design for your program.