

## CS 2073, Computer Programming with Engineering Applications

### *Spring 1992, Exam 2, Answers*

The material in **boldface** is the answer.

```

program quest1;
var x, y: real;
    i, j: integer;
procedure stars(n: integer);
var i: integer;
begin
    for i := 1 to n do
        write('*');
        writeln
    end;
begin
    x := 0;
    for i := 0 to 50 do
        begin
            y := sin(x);
            j := round(y*20.0);
            stars(j);
            x := x + 1/16.0
        end
    end.
    (*****)
program quest2;
var seed: double;
    i: integer;
    temp: double;
    COUNT, N: integer;
    x, y: double;

function random(var seed: double): double;
(* return a random double precision real
 * between 0 and 1. Update parameter seed
 *)
const
    a = 16807.0;      (* multiplier *)
    m = 2147483647.0; (* modulus *)
    (* on the VAX, this must be 2147483647.0D0 *)
    q = 127773.0;    (* m div a *)
    r = 2836.0;      (* m mod a *)
var
    lo, hi, test: double;
begin
    hi := trunc(seed/q);
    lo := seed - q*hi;
    test := a*lo - r*hi;
    if test > 0.0 then
        seed := test
    else
        seed := test + m;
    random := seed/m
end; (* random *)

begin
    seed := 1.0;
    for i := 1 to 100000 do
        temp := random(seed);
        writeln('Seed:', seed:18:6, ', should be 46831694.000000');
        (* part (a) *)
    for i := 1 to 10 do
        writeln('Random real:', random(seed):20:17,
            ', Seed:', seed:12:0);
        (* part (b) *)

```

```

if random(seed) < 0.5 then
  writeln('HEADS')
else writeln('TAILS');
(* part (c) *)
COUNT := 0;
readln(N); (* say, N = 1000 *)
for i := 1 to N do
begin
  x := random(seed) - 0.5;
  y := random(seed) - 0.5;
  if sqr(x) + sqr(y) <= 0.25 then
    COUNT := COUNT + 1
  end;
writeln(COUNT/N:20:10,
  ' Exact value:', 3.14159265358979/4.0:20:10);
writeln('Th-th-th-th-that''s-all-folkes!')
end.
Sample results for different values of N:

```

N	Approximation	Exact Value
1000	0.77900000	0.7853981634
1000	0.79800000	0.7853981634
100000	0.78526000	0.7853981634
1000000	0.78508500	0.7853981634
10000000	0.78536660	0.7853981634

```

(*****

```

```

PROGRAM Quest3;
CONST N = 4;
TYPE Atype = ARRAY[1..N] OF integer;
VAR A, B: Atype;

PROCEDURE READ_ARR (VAR A: Atype);
VAR I: integer;
BEGIN
  FOR I := 1 TO N DO
    read(A[I])
  END; (* READ_ARR *)

FUNCTION SUM (A: Atype): integer;
VAR I: integer;
    run_sum: integer;
BEGIN
  run_sum := 0;
  FOR I := 1 TO N DO
    run_sum := run_sum + A[I];
  SUM := run_sum
END; (* SUM *)

PROCEDURE PROD (X, Y: Atype; VAR Z: Atype);
VAR I: integer;
BEGIN
  FOR I := 1 TO N DO
    Z[I] := X[I]*Y[I]
  END; (* PROD *)

FUNCTION INNER_PROD (A, B: Atype): integer;
VAR C: Atype;
BEGIN
  PROD(A, B, C);
  INNER_PROD := SUM(C)
END; (* INNER_PROD *)

BEGIN
  READ_ARR(A); READ_ARR(B);
  writeln(INNER_PROD(A, B))
END.

```