1. (20 points) Write 1-2 line answers for each of the following parts.

    (a) (4 points) What is the response you expect to the following lines of code? Why?

    ```
    a:= proc(n::integer)
    print(n);
    end proc;

    a(3.1);
    ```

    Solution: The precise error message output by Maple is *Error, invalid input: a expects its 1st argument, n, to be of type integer, but received 3.1.* If you paraphrase this you would get credit.

    (b) (4 points) What is the response you expect to the following lines of code?

    ```
     a := 2; d := 3;
     evalb(a = d);
    ```

    Solution: False, because $2 \neq 3$.

    (c) (4 points) What is the response you expect to the following lines of code? Why?

    ```
    a:= proc(n::integer)
    local b;
    b:=n+n;
    end proc;

    a(3);
    b;
    ```

    Solution: The procedure call $a(3)$ returns 6 but b is not defined (there is no error though) since the assignment of 6 to b was within a procedure, where b was a local variable.

    (d) (4 points) Add a comment of the form "This procedure....." to the following procedure to make it very easy for a Maple programmer to understand.

    ```
    a:=proc(n::float)
    if frac(log2(n))=0 then return 1;
    else return 0;
    end if;
    end proc;
    ```

    Solution: This procedure returns 1 if the input is a positive power of 2 and 0 otherwise.

    Note: Most languages would throw an exception (error) when you call a() with input 0.0 but Maple does not and the procedure works as intended.

    (e) (4 points) What is the value of d in the following lines of code? Why?

    ```
    a := proc (n::integer)
     local b;
     b := 2*n;
     print(b);
    end proc;

    bb := proc()
     local c;
    ```

```
  c := a(4);
   return c
 end proc;
```

```
 d := bb();
```
Solution: The correct answer is that d is NULL but "d is undefined" would get you full credit. The reason that d is not 8 is because the procedure a prints but does not return 8. Therefore c is not set in procedure bb and it follows that d is not set to 8.

Note: Some students have claimed d is 8 on their versions of Maple. I have not seen the claim being substantiated. My answer is based. on Maple 12.

2. (a) (5 points) Write down a Maple command to plot a line segment joining (2,2) and (2,3). You must use do this by using an appropriate function and invoking it in a plot command.
   Solution:
   ```
   plot([2,t,t=2..3]);
   ```
   Note:
   ```
    plot([2,t],t=2..3)
   ```
   produces a set of 2 curves – completely different from what the question asks.

   (b) (7 points) Use the seq() command to compute the set $\{2^i : 1 \leq i \leq 100\}$.
   Solution:
   ```
   {seq(2^i:i=1..100)}
   ```

   (c) (8 points) Use the map() command to compute the set $\{i^2 : 1 \leq i \leq 100\}$.
   Solution:
   ```
   map(i->i^2,{seq(i,i=1..100)})
   ```

3. (10 points) Write a procedure that contains two local functions. The procedure should take as input an integer n. The first function should compute the number of digits of n. The second function should compute the ith digit of n. The procedure must use these functions to return the largest digit used in the decimal representation of n. For example, if $n = 1238$, the procedure should return 8.
   Solution:

   ```
   p2 := proc (n::integer)
   local x, i,numdig,ithdig;

   numdig := n -> 1+trunc(evalf(log10(n)));
    ithdig := (n, k) -> iquo(irem(n, 10^k), 10^(k-1)) ;

   x := {seq(ithdig(n, i), i = 1 .. numdig(n))};
   return max(x)
   end proc;
   ```

   Note: A very minor twist on a solved practice problem for the midterm.

4. (10 points) Write a procedure that takes as input an integer n and returns a set defined by $\{2^i : i \text{ is a factor of } n\}$.
   Solution:

   ```
   expfactorlist := proc (n::integer)
   local divisor,rset;
   divisor :=  (n, i) -> piecewise(frac(n/i) = 0,2^ i, frac(n/i) <> 0, -100);
   rset:={seq(divisor(n, i), i = 1 .. n)} minus {-100}
   return map(i->2^i,rset);
   end proc;
   ```