Homework 4 Solutions

1. Trace the following algorithm. What is the result? Show your work.

```
ALG
val <- 20
x <- 5
while x < 35
   val <- x + val * 2
   x <- x + 6
display val
END
```

val	x
~~20~~	~~5~~
~~45~~	~~11~~
~~101~~	~~17~~
~~219~~	~~23~~
~~461~~	~~29~~
951	35

Thus, 951 is displayed.

2. Trace the following algorithm. In general, what does it find? Give two examples.

```
ALG
// assumes n is an integer and n > 0
x <- 0
y <- 1
input n
if n = 1 then
   display x
else if n = 2 then
   display y
else
   for count <- 3 to n
      z <- x + y
      display z
      x <- y
      y <- z
END
```

This finds the n^{th} Fibonacci number. The Fibonacci sequence is as follows:

n:	1	2	3	4	5	6	7	etc.
$f(n)$:	0	1	1	2	3	5	8	

That is, the next number in the sequence is found by adding the two previous numbers.

3. Using pseudocode, write an algorithm to calculate and display the area of a circle given the diameter ("given" means "as user input").

```
ALG
input diameter
area <- 3.14159 * (diameter/2) * (diameter/2)
print area
```

4. Using pseudocode, write an algorithm to calculate and display the decimal value of a given binary number. Assume the binary number will be input one digit at a time, **backwards**, and that six digits will always be input. For example, if the binary value is 110_2 (which is equal to 6_{10}), it will be input as 0 1 1 0 0 0.

```
ALG
val <- 0
for i <- 0 to 5
   input digit
   val <- val + digit * 2^i
print val
```

5. Using pseudocode, write an algorithm to calculate and display the result of an input expression of the form:

$$x \texttt{ op } y$$

where `op` is $+, -$, or $*$. If `op` is none of these, the algorithm should display an error message.

```
ALG
input x
input op
input y
if op = '+' then
   print x + y
else
   if op = '-' then
      print x - y
   else
      if op = '*' then
         print x * y
      else
         print "Error"
```