HW2 Solutions

1. What acts as an intermediary between a high-level programming language and the ISA? (1)
Compiler converts programming language into ISA instructions.

2. In the classic parable mentioned in the chapter, what exactly caused the trouble? How do computer programming languages and algorithms avoid such a situation? (2)
The wife did not specify six of “what”, leading the husband to believe that the object in question was milk and not eggs. Objects need to be defined by name at each point in an algorithm.

3. Define efficiency and scalability. How are they related? Under what circumstances will you not bother making your program more efficient? (2)
Efficiency: how much of a given resource an algorithm may require under various circumstances.
Scalability: how well an algorithm performs when applied to scaled-up (larger) versions of the same problem.
The question of which one you should be concerned with depends on the problem statement. If an algorithm uses too much of a certain resource (memory) but the problem statement prioritizes resources that it does well (time), you may decide not to make the program more efficient.

4. Step through this example program and print x and y at each step (2)

```plaintext
x = 5           # x = 5; y = uninitialized
y = x + 4       # x = 5; y = 9
x = 3           # x = 3; y = 9
x = 5*x + 2*(3 - y)  # x = 3; y = 9
```

5. Generally, once one line’s instruction is completed, the next instruction to be run is the one on the following line. What type of instructions are an exception to this general rule? (1)
branching or jump instructions

6. What role does the backslash character (\) play in Python syntax? Give an example line of code where it will be useful. (2)
The backslash is used to “escape” characters, meaning that the character after it doesn’t have its usual meaning.
Example:
```plaintext
print("\"You miss 100% of the shots you don’t take!" - Wayne Gretzky - Michael Scott")
```
7. What is an operation permitted on strings in Python? Give an example of its usage.  (2)

Lots of examples, but the easiest one is print. print("Hello world!"), etc.

8. How many times will the “hello” be printed by each of the following sequence of statements? What is the value of i at the end in each case?

   a.  
   ```python
   i = 0
   while (i < 10):
       print("hello")
       i = i + 1
   ```

   b.  
   ```python
   i = 3
   while (i <= 10):
       print("hello")
       i = i + 1
   ```

   c.  
   ```python
   i = 0
   while (i < 2):
       j = 0
       while (j < 3):
           print("hello")
           j = j + 1
       i = i + 1
   ```

   a. 10 times, i = 10  
   b. 8 times, i = 11  
   c. 6 times, i = 2

9. Assuming there is no code before these lines, which lines of code would produce errors? Explain.  (2)

   a. “word” + 2  
   b. “word” + “word”  
   c. x = word  
   d. “word”/“word”

   a) no wrong answer to part a because the simulator changed  
   d) because you can’t divide strings
10. Write a program to swap (exchange) the values of two variables a and b. Check the code on the browser-based simulator. You may create additional variables if needed. (2)

Lots of solutions, but sample:

```python
a = 2
b = 1
temp = a
a = b
b = temp
```

11. Write a program to print the first n Fibonacci numbers. (Initialize n as 15). Start with 0 and 1 as the first two numbers. The next number is created by adding the previous two numbers. Thus, the series would go like this: 0 1 1 2 3 5 8 ..... Check the code on the browser-based simulator. (3)

```python
n = 15
counter = 1
a = 0
b = 1

print(a)
while(counter<n):
    print(b)
temp = b
b = b + a
a = temp
counter = counter + 1
```

Output: 0 1 1 2 3 5 8 13 21 34 55 89 144 233 377
12. Say you wanted to print out the Celsius equivalent for all integer Fahrenheit temperatures from -50 degrees F to 50 degrees F. Write a program to print out this conversion information. The pseudocode for implementing this is given below.

The equation for converting Fahrenheit (F) to Celsius (C) is: (F-32) x (5/9)  

i. Set F's initial value to -50 (lower bound)  
ii. While F is less than or equal to 50 (upper bound)  
iii. Convert Fahrenheit to Celsius.  
iv. If Fahrenheit and Celsius are equal, print “Fahrenheit and Celsius are equal at -40 degrees!”  
v. Else print the number of degrees in Fahrenheit followed by the number of degrees in Celsius in the format “Fahrenheit: F, Celsius: C” (note: to print numbers and strings in a single statement, use print("F=" + F + ", , " + "C=" + C) where F and C are your numeric values.  
vi. Increment F  

Check the code on the browser-based simulator.

One solution:

```python
F = -50
while(F <= 50):
    C = (F-32)*(5/9)
    if (F==C):
        print("Fahrenheit and Celsius are equal at -40 degrees!")
    else:
        print("F=", F, ", C=", C)
    F = F +1
```