

Examination 2

CSC140 Foundations of Computer Science

19 February 2016

1. In your lifetime, technological innovation has made it possible for a young person to reach an audience of millions overnight. Sometimes the popularity of an idea surprises its author. Sometimes the publication of creative work on the Web opens the doors to new careers.

Which very popular Web sites did Matt Harding, Rob Malda, and Eric Weisstein create?

Write your answer here.

2. In what sense are all programming languages equivalent?

Write your answer here.

3. What is one distinguishing feature of the Java programming language?

Write your answer here.

4. Let us suppose that the speed of the Starship Enterprise depends upon the rate at which matter and antimatter are fed into the warp engines and on the age of the reactor's dilithium crystals.

Write a stub method that computes the ship's speed (expressed as a warp factor—a value between 1.0 and 10.0, such as 5.2), given the rate of consumption of matter and antimatter (a fraction of the maximum rate—its

value will be a number between 0.0 and 1.0) and the age of the crystals (measured as a whole number of years).

// Write your answer here.

5. The sequential search algorithm is $O(n)$. The binary search algorithm is $O(\log n)$. What is the meaning of this difference?
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Write your answer here.

6. Avogadro's constant is the number of atoms or molecules in a mass of specified size.

$$N_A \approx 6022000000000000000000000000$$

Although it is a whole number, its value should be stored in a **double** variable rather than an **int** variable. Why?

Write your answer here.

7. Rewrite this method with a **for** loop in place of the **while** loop.

```
int fun( int n ) {  
    int i = 0;  
    int sum = 0;  
    while( i < n ) {  
        sum += 2 * i + 1;  
        i++;  
    } // while  
    return sum;  
} // fun( int )
```

// Write your answer here.

8. Write a method that computes an approximation of $\sin \theta$ using this formula: $\sin(\theta) \approx \theta - (\theta^3/6)$
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// Write your answer here.

9. What does this method do?

```
void f( int i, int j, int [] data ) {  
    int temp = data[i];  
    data[i] = data[j];  
    data[j] = temp;  
} // f( int, int, int [] )
```

Write your answer here.

10. What does this method do?

```
int g( int i, int [] data ) {  
    int result = i;  
    for( int j = i + 1; j < data.length; j++ ) {  
        if( data[j] < data[result] ) {  
            result = j;  
        } // if  
    } // for  
    return result;  
} // g( int, int [] )
```

Write your answer here.

11. What does this method do?

```
void h( int [] data ) {
    for( int i = 0; i < data.length; i++ ) {
        int j = g( i, data );
        f( i, j, data );
    } // for
} // h( int [] )
```

Write your answer here.

12. Write a method that computes the sum of the trace of a matrix. The trace of a matrix is the sum of the elements found on the main diagonal of the matrix.

$$M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$
$$\text{trace}(M) = 1 + 5 + 9$$
$$= 15$$

// Write your answer here.