How many ways are there to rearrange all the letters in INANENESS? ______

A) \(\frac{3!2!1!1!}{9!}\)  
B) \(\frac{9!}{(3^2\cdot2\cdot1\cdot1)!}\)  
C) \(9^{3\cdot2\cdot1\cdot1}\)  
D) \(P(9,9)\)  
E) \(P(9,(3,2,2,1,1))\)  
F) \(\frac{9!}{(3+2+2+1+1)!}\)  
G) \(C(9,3) + C(6,2) + C(4,2) + C(2,1) + C(1,1)\)  
H) \(C(9,3) \cdot C(6,2) \cdot C(4,2) \cdot C(2,1) \cdot C(1,1)\)  
I) \(P(9,3) \cdot P(6,2) \cdot P(4,2) \cdot P(2,1) \cdot P(1,1)\)

In a class of 48 UCSD students, there will always be a group of at least _____ who have the same last digit in their 8-digit student id?

A) \(C(48,8)\)  
B) 3  
C) 4  
D) 5  
E) 6  
F) 7  
G) \(C(48,10)\)

Say there is a game of chance where you flip a standard 2-sided coin five times.

What is the probability of flipping more than 3 heads? Express your answer in terms of a non-reduced fraction.

\(P(X > 3) = \) __________

If the payout for flipping 4 heads is 3-to-1 (for example, $1 bet pays $3 + the original $1 bet for a total of $4) and the payout for flipping 5 heads is 9-to-1 (for example, $1 bet pays $9 + the original $1 bet for a total of $10), the Expected Value of the amount of money you will win (your return) in terms of \(P(X > 3)\) is

\(E(X) = 4 \cdot P(X=4) + 10 \cdot P(X=5) + 0 \cdot P(X \leq 3)\)

Now replace the \(P(X=x)\) values with their numeric probabilities keeping your answer in terms of non-reduced fractions vs. decimals.

\(E(X) = 4 \cdot \text{___________} + 10 \cdot \text{___________} + 0 \cdot \text{___________} = \text{___________}\)

If your bet is $1 (costs you $1 to play), what is your expected return each time you make this kind of bet? Express your answer as a positive or negative non-reduced fraction.

\(E(X) - 1 = \text{___________}\)

A random number generator produces a sequence of 20 digits (0,1,…,9).

a) What is the probability that the sequence contains all 0s? _____

A) \(1/10^{20}\)  
B) \(20/10^{20}\)  
C) \(1/10!\)  
D) \(C(20,10)/C(20,20)\)  
E) \(1/20^{10}\)  
F) \(20/20^{10}\)  
G) \(1/20!\)  
H) \(C(20,20)/C(20,10)\)

b) What is the probability that the sequence contains at least one 3? ________________
Consider the following algorithm:

\[
x \leftarrow 1 \\
\text{for } i \in \{1, 2, 3\} \text{ do} \\
\quad \text{for } j \in \{1, 2, 3\} \text{ do} \\
\quad \\
\quad \quad x \leftarrow x + x \\
\quad \text{for } k \in \{1, 2, 3, 4\} \text{ do} \\
\quad \quad x \leftarrow x + 1 \\
\quad x \leftarrow x + 5 \\
\]

Count the number
of + operations done by this algorithm. ______

Consider the following algorithm #1:

```cpp
char alphabet[] = "ABCDEFGHIJKLMNOPQRSTUVWXYZ";
for ( int i = 0; i < n; ++i )
{
    for ( int j = 0; j < n; ++j )
    {
        cout << alphabet[i] << alphabet[j] << alphabet[i];
    }
}
```

How many characters are output in terms of \(n\)?

_______ (in terms of \(n\))

Consider the following algorithm #2:

```cpp
for ( int i = 0; i < n - 1; ++i )
{
    for ( int j = i + 1; j < n; ++j )
    {
        if ( array[i] == array[j] )
        {
            ++numOfDuplicates;
        }
    }
}
```

How many "==" comparisons are made in terms of \(n\)?

__________ (give answer in terms of \(n\))

How many "==" comparisons are made if \(n\) is 8?

_______ (give an exact number answer)

To count the number of comparisons in the above code, on which line should you add ++numOfComparisons? _____

Consider the following algorithm #3:

```cpp
for ( int i = 0; i < n - 1; ++i )
{
    for ( int j = 0; j < n - 1 - i; ++j )
    {
        if ( array[j] > array[j+1] )
        {
            /* swap array[j] and array[j+1] */
        }
    }
}
```

A) Niklaus Wirth
B) John McCarthy
C) John Backus
D) All of the above
E) None of the above

_____ Not a Turing Award winner
_____ Father of Fortran
_____ Father of Lisp

_____ Popularized the adage "Software is getting slower more rapidly than hardware becomes faster."

_____ Invented the term "artificial intelligence"