In a class of 11 boys and 9 girls, the teacher selects three students at random to write problems on the board.

a) What is the probability that all the students selected are boys? _____

1) $\frac{3}{20}$  3) $\frac{3!}{20}$  5) $\frac{\binom{11}{3}-\binom{9}{3}}{\binom{20}{3}}$  7) $\frac{\binom{11}{3}}{\binom{20}{3}}$

2) $\frac{3}{11}$  4) $\frac{3!}{11}$  6) $\frac{\binom{11}{3}-\binom{9}{3}}{\binom{20}{11}}$  8) $\frac{\binom{11}{3}}{\binom{20}{11}}$

b) If we calculate the probability that all the students selected are girls, which has a greater probability? _____

1) All students selected are boys  2) All students selected are girls  3) They are the same

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

1) $\frac{3!2!2!}{12!}$  4) $\binom{12,12}$  7) $\binom{12,3}+\binom{9,2}+\binom{7,2}+\binom{5,1}+\binom{4,1}+\binom{3,1}+\binom{2,1}+\binom{1,1}$

2) $\frac{12!}{(3\times2\times2)!}$  5) $\binom{12,3}\times\binom{9,2}\times\binom{7,2}\times\binom{5,1}\times\binom{4,1}\times\binom{3,1}\times\binom{2,1}\times\binom{1,1}$

3) $\frac{12^{3\times2\times2}}{}$  6) $\frac{9!}{(3+2+2)!}$  8) $\binom{12,3}\times\binom{9,2}\times\binom{7,2}\times\binom{5,1}\times\binom{4,1}\times\binom{3,1}\times\binom{2,1}\times\binom{1,1}$

3) $\frac{12}{3\times2\times2}$  6) $\frac{9!}{3+2+2}!$  9) $\binom{12,3}\times\binom{9,2}\times\binom{7,2}\times\binom{5,1}\times\binom{4,1}\times\binom{3,1}\times\binom{2,1}\times\binom{1,1}$

What kind of problem is this? _____

1) Simple Selection Principle  4) Simple Arrangement Principle  7) Straight Probability

2) Inclusion-Exclusion Principle  5) Complement & Subtract Prob.  8) Expected Value

3) (Generalized) Pigeon Hole Principle  6) Multichoose/Multisets  9) Multinomial Coefficient

(stars and bars problem) (MISSISSIPPI problem)

Write the simplified version of the above answer: ______________ / ______________

A small college offers 95 different classes. No two classes can meet at the same time in the same room. There are 10 different time slots at which classes can occur. What is the minimum number of classrooms needed to accommodate all the classes? _____

1) 9  2) 10  3) 15  4) 16  5) 95  6) 96  7) 1 if the room was big enough

What kind of problem is this? _____

1) Simple Selection Principle  4) Simple Arrangement Principle  7) Straight Probability

2) Inclusion-Exclusion Principle  5) Complement & Subtract Prob.  8) Expected Value

3) (Generalized) Pigeon Hole Principle  6) Multichoose/Multisets  9) Multinomial Coefficient

(stars and bars problem) (MISSISSIPPI problem)

Using two fair 6-sided dice, what is the probability you will roll a 10 or less?

Probably the easiest (least calculations) way to solve this problem is with which of the following? _____

1) Inclusion-Exclusion Principle  4) Complement & Subtract  7) Expected Value

2) (Generalized) Pigeon Hole Principle  5) Multiplication Principle  8) Addition Principle

3) A Single Selection  6) A Single Arrangement  9) Straight Probability

Now to answer the original question: _____

1) $\frac{3}{36}$  2) $\frac{10}{36}$  3) $\frac{11}{36}$  4) $\frac{23}{36}$  5) $\frac{30}{36}$  6) $\frac{33}{36}$  7) $\frac{51}{36}$
Consider the following algorithm:

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

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];
    }
}
```

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 6? ______ (give an exact number answer)

Consider the following algorithm #3:

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

To count the number of swaps in the above code, on which line should you add ++numOfSwaps? ______

The number of swap statements executed by a bubble sort varies depending on the initial state of the array.

Under what circumstances will the bubble sort make the most swaps? _____

Under what circumstances will the bubble sort make zero swaps? _____

1) Only two elements in array  2) Never  3) Already sorted  4) Sorted in the opposite order

_____ Father of Pascal  1) John McCarthy  
_____ Father of Lisp  2) John Backus
_____ Turing Award winner  3) Niklaus Wirth
_____ Father of Fortran  4) All of the above

_____ Invented garbage collection to reclaim memory occupied by objects that are no longer used in a program