## Instructions
1. Do all of the 5 problems
3. You have 70 minutes for the exam
4. Show all your work
5. Do not separate midterm papers

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1. (20 pts) Complete the following program to find the average and standard deviation of the numbers in an array. For example, the array \{2, 4, 6, 3, 9, 10\} has standard deviation of average of 5.666667 and standard deviation of 2.981424. Formula for standard deviation is as follows.

\[
\text{stddev} = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (x_i - x_{avg})^2}
\]

In the formula \(n\) denotes the number of items in the set, \(x_i\) denotes \(i^{th}\) number and \(x_{avg}\) denotes the average of the numbers in the set.

```c
#include <stdio.h>
#include <math.h>

int main()
{
    double stddev;  //standard deviation
    int i;
    double num[6];  // array to store the numbers
    double average, double sum=0;

    printf("Enter 6 doubles\n");
    for (i=0; i<6; i++)
        scanf("%lf",&num[i]);

    printf("Average is %.2lf\n",average);
    printf("Standard Deviation is %.2lf\n",stddev);
    return(0);
}
```
2. (20 pts) Trace the execution of the following program? What will be the final values of array `a` printed for the cases given below.

```c
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int a[7] = {1, 1, 0, 0, 0, 0, 0};
    int i = 2;

    while (i < 7)
    {
        if (i < 5)
            a[i] = a[i - 1] + a[i - 2];
        else
            a[i] = a[i - 3];
        i = i + 1;
    }

    for (i = 0; i < 7; i++)
        printf("a[%d] = %d\n", i, a[i]);
}
```

(a) What will be the final array when initial array is `a[7] = {1, 1, 0, 0, 0, 0, 0}`?

(b) What will be the final array when initial array is `a[7] = {4, 2, 3, 6, 4, 2, 5}`?
3. (20 pts) Write a function `Powerof3` to test if a parameter $n$ is a power of 3 ($n = 3^k$ for some integer $k$). If $n$ is a power of 3, then the function returns 1. Otherwise it returns 0. Function prototype and sample output of the function and description of the output is given below.

For $n=5$ function returns 0 since $3^1 = 3 < 5 < 3^2 = 9$

For $n=9$ function returns 1 since $9 = 3^2$

For $n=30$ function returns 0 since $3^3 = 27 < 30 < 3^4 = 81$

For $n=27$ function returns 1 since $27 = 3^3$

```c
int Powerof3(int n)
{
}
```
4. (20 pts) What is the output of the following program? Show all your work for partial credit.

```c
#include <stdio.h>

int function1(int x)
{
    return(2*x+1);
}

int main()
{
    int j=3;

    while (j < 50)
    {
        if (j<10)
            j = function1(j-1);
        else
            j = function1(j)-1;
        printf("%d\n",j);
    }

    return(0);
}
```
5. (20 pts) Write a complete program to compute the following expression. Read the value of \( n \) from the user and write a loop to evaluate the product. \( \prod \) denotes multiplication of all the terms.

\[
\frac{1}{2 \cdot 1 - 1} \ast \frac{2}{2 \cdot 2 - 1} \ast \ldots \ast \frac{i}{2 \cdot i - 1} \ast \ldots \ast \frac{n}{2 \cdot n - 1} = \prod_{i=1}^{n} \frac{i}{2i - 1}
\]