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NAME: __________________________

**Instructions**
1. Do all of the 4 problems
2. You have 50 minutes for the exam
3. Show all your work
4. Do not separate midterm papers

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1. (30 pts) Complete the following program to find the difference of a set of numbers in an array. Difference of a set of numbers is the difference between largest element and smallest element in the set. For example, the array \(\{2, 4, 6, 3, 9, 10\}\) has difference of 8 since largest element is 10 and smallest element is 2 resulting in difference of 10-2=8.

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

int main()
{
    int i;
    double num[6];
    double max;
    double min;
    double difference;

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

    max = num[0];
    min = num[0];
    for (i=1; i<6; i++)
        if (max < num[i])
            max = num[i];
        else if (min > num[i])
            min = num[i];

    difference = max - min;
    printf("Difference is \%lf\n", difference);
    return(0);
}
```
2. (20 pts) Trace the execution of the following program. What will be the final values of array a printed?

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

int main()
{
    int a[7]={1,2,4,8,16,32,64};
    int i;
    for (i=1; i<6; i=i+2)
        if (i<4)
            a[i] = (a[i-1]+a[i+1])/2;
        else
            a[i] = a[6-i];
    for (i=0; i<7; i++)
        printf("a[%d] = %d\n", i, a[i]);
}
```

Final values of array a:

- `a[0] = 3`
- `a[1] = 2`
- `a[2] = 11`
- `a[3] = 10`
- `a[4] = 1`
- `a[5] = 2`
- `a[6] = 64`
3. (20 pts) What is the output of the following program? Show all your work for partial credit.

```c
#include <stdio.h>

int function1(int a, int b)
{
    return((a-1)*(b+1)/2);
}

int main()
{
    int i;
    int x;

    for (i=2; i<10; i=i+1)
    {
        if (i>10)
        {
            x = function1(i,i-1);
        } else
        {
            x = function1(i-1,i);
        }
        printf("%d\n",x);
    }

    return(0);
}
```

Output:

```
0
2
5
9
14
20
27
35
```

```
x=function(1,2) 
  x=0

x=function(2,3) 
  (2-1)*(3+1)/2 = 2

x=function(3,4) 
  (3-1)*(4+1)/2 = 5

x=function(4,5) 
  (4-1)*(5+1)/2 = 9

x=function(5,6) 
  (5-1)*(6+1)/2 = 14

x=function(6,7) 
  (6-1)*(7+1)/2 = 20

x=function(7,8) 
  (7-1)*(8+1)/2 = 27

x=function(8,9) 
  (8-1)*(9+1)/2 = 35
```
4. (30 pts) Write a **complete program** to compute the following expression. Read the value of \( n \) from the user and write a **single loop** to evaluate the expression.

\[
\sum_{i=1}^{n} \frac{1}{i} + \sum_{i=1}^{n} \frac{1}{2^i}
\]

\[
\frac{241}{2^6} + \frac{1}{2^6} = \frac{3}{2^6}
\]

\[
\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}
\]

```c
#include <stdio.h>

int main()
{
    int i, n;
    float sum = 0;
    printf("Enter n \n");
    scanf("%d", &n);
    for (i = 1; i <= n; i++)
    {
        sum += 1.0 / i + 1.0 / (2 * i);
    }
    printf("sum = %f \n", sum);
    return(0);
}
```