MTH 3300 STRA Midterm

March 13, 2025

Please provide your answers in the spaces below. Good luck!

1. (5 points) Convert the following numbers:

(a) 23_{10} to binary

(b) 110101_2 to decimal

 $2.\ (5 \ {\rm points})$ What will the following code block output? Justify your answer.

```
s = "mississippi"
result = ""
for i in range(len(s)):
    if s[i] in "is" and i % 2 == 0:
        result += s[i].upper()
    elif s[i] in "ip":
        result += "-"
    else:
        result += s[i]
```

print(result)

3. (10 points) We can define the Tribonacci sequence ${\cal T}_n$ as follows:

$$T_{n+3} = T_n + T_{n+1} + T_{n+2}$$
 for $n \ge 2$

where $T_0 = 0, \, T_1 = 1, \, \text{and} \, T_2 = 1.$

Write a program that takes a number n from the user and calculates the nth Tribonacci number.

4. (5 points) What will the following code block output? Justify your answer.

```
s = "racecar"
new_s = ""
for i in range(len(s)):
    if s[i] == s[-(i + 1)]:
        new_s += "*"
    else:
        new_s += s[i]
```

print(new_s)

- 5. (10 points) Write a program that takes an integer n from the user and prints the following pattern: Suppose that n = 5, we should expect the following output:
 - * ** *** ****

6. Given the following summation:

$$144\sqrt{2} + 121\sqrt{4} + 100\sqrt{6} + \ldots + 4\sqrt{22}$$

Write a program that computes the above summation using a:

(a) while-loop (5 points)

(b) for-loop (5 points)

7. (25 points) A run-length encoded string is a simple way of encoding a string based on the number of consecutive duplicate characters. For example, if we have a string word = "aaabbcaa", we can encode such a string to be end up being a3b2ca2. Notice that if the character only appears once, we don't add 1 to the end of the new string.

Write a program that takes an input word from the user and encodes the string in such a manner.