Q1
5 Points

Q1.1
1 Point

Assuming the alphabet size is R, what is the *amortized* runtime of the DFA construction step in the KMP string-matching algorithm over k searches when searching for the same pattern string (of length m) over k different text strings (each of length n)?

- [x] $\Theta(\frac{mR}{k})$
- [ ] $\Theta(\frac{nR}{k})$
- [ ] $\Theta(mR)$
- [ ] $\Theta(kR)$

Q1.2
1 Point

Assuming the alphabet size is R, what is the *amortized* runtime of the DFA construction step in the KMP string-matching algorithm over k searches when searching for k different pattern strings (each of length m) over the same text string (of length n)?

- [ ] $\Theta(\frac{mR}{k})$
- [ ] $\Theta(\frac{nR}{k})$
- [x] $\Theta(mR)$
- [ ] $\Theta(kR)$

Q1.3
1 Point

All brute-force algorithms have exponential worst-case runtime.

- [ ] True
- [x] False

Q1.4
1 Point

Which of the following text-pattern pairs results in the worst-case runtime for the Boyer-Moore string-matching algorithm?

- [x] text = XXXXXXXXXXXXXXXXXXXXXXXXXXXXX and pattern = YXXXXXX
- [ ] text = XXXXXXXXXXXXXXXXXXXXXXXXXXXXX and pattern = XXXXXXY
- [ ] text = XYXYXYZXXXXXXXXXXXXXX and pattern = XYXYZ
- [ ] text = ABCDVABCDWABCDXABCDYABCDZ and pattern = ABCDE

Q1.5
1 Point

Which of the following text-pattern pairs results in the worst-case runtime for the brute-force string-matching algorithm?

- ○ text = XXXXXXXXXXXXXXXXXXXXXXXXXXXXX and pattern = YXXXXXX
- ◉ text = XXXXXXXXXXXXXXXXXXXXXXXXXXXXX and pattern = XXXXXXY
- ○ text = XYXYXYZXXXXXXXXXXXXXX and pattern = XYXYZ
- ○ text = ABCDVABCDWABCDXABCDYABCDZ and pattern = ABCDE

Q2
6 Points

Q2.1
2 Points

Consider the following open-addressing hash table, with $h(x) = x \bmod 11$. Also, consider the following keys (in order): $17, 24, 30, 37, 13, 18$.

Linear Probing	
Index	Key
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Assume that linear probing is being used for collision resolution. Draw the table after the keys shown above are inserted in the given order.

2.1.docx Download

```
1  Large file hidden. You can download it using the button above.
```

Q2.2

1 Point

What is the total number of collisions in the previous question?

1

Q2.3
2 Points

Consider the following open-addressing hash table, with $h(x) = x \bmod 11$. Also, consider the following keys (in order): $17, 24, 30, 37, 13, 18$.

Double Hashing	
Index	Key
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Assume that double hashing is being used for collision resolution, with $h_2(x) = (x \bmod 7) + 1$. Show the table after the keys shown above are inserted in the given order. For each collision indicate the value(s) of $h_2(x)$ for the colliding key x.

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```
1  Large file hidden. You can download it using the button above.
```

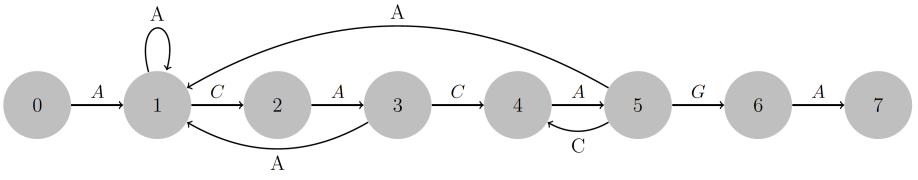
Q2.4
1 Point

What is the total number of collisions in the previous question?

2

Q3
13 Points

The KMP string-matching algorithm computes the first index `i` of a text string `txt` of length `n` such that each of the `m` characters in the substring of `txt` starting at `i` matches the corresponding character in a pattern string `pat` of length `m`. Consider the below DFA, which resulted from pre-processing a particular pattern string. Answer the following questions using the given DFA.



Q3.1
1 Point

The pattern string is

ACACAGA

Q3.2
1 Point

The length of the pattern string is:

7

Q3.3
1 Point

Assuming the characters that appear in the pattern string are the only characters that appear in the alphabet, then the alphabet size `R` =

3

Q3.4
1 Point

If the DFA is in state 4, then the last four characters processed from the text string are

ACAC

Q3.5
1 Point

If the last six characters processed from the text string are `ACACAC`, then the DFA is in which state?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ◉ 4
- ○ 5
- ○ 6
- ○ 7

Q3.6
1 Point

Assume the 2-dimensional array `dfa[][]` is used to represent the above DFA. What is the value of `dfa[2]['A']`?

3

Q3.7
1 Point

The runtime of DFA construction in terms of m, n, and R is

O(Rn)

Q3.8
1 Point

What is the restart state after a mismatch in the sixth character of the pattern, that is, after matching `ACACA`?

4

Q3.9
3 Points

Construct the DFA for the following pattern. Draw the DFA **and** represent it as a 2-d array dfa[m].

pattern = `ACTACACTA`

2.9.docx Download

```
1  Large file hidden. You can download it using the button above.
```

Q3.10

1 Point

Given the below code for the KMP search algorithm, assuming a match was found starting from index `7` and the pattern string is `10` characters-long. What is the values of `i` right after the `for` loop?

```
public int kmp_search(String pat, String txt){
   int m = pat.length();
   int n = txt.length();
   int i, j;
   for (i = 0, j = 0; i < n && j < m; i ++)
      j = dfa[j][txt.charAt(i)];
   if (j == m) return i-m;
   return n;
}
```

`i =`

8

Q3.11

1 Point

Given the below code for the KMP search algorithm, assuming a match was found starting from index `7` and the pattern string is `10` characters-long. What is the values of `j` right after the `for` loop?

```
public int kmp_search(String pat, String txt){
   int m = pat.length();
   int n = txt.length();
   int i, j;
   for (i = 0, j = 0; i < n && j < m; i ++)
      j = dfa[j][txt.charAt(i)];
   if (j == m) return i-m;
   return n;
}
```

`j =`

10

Q4

13 Points

Consider the mismatched character heuristic of the Boyer-Moore string matching algorithm. The pattern string is `ABRACADABRA`. Answer the following questions.

Q4.1

1 Point

`right['A'] =`

10

Q4.2
1 Point

`right['B'] =`

8

Q4.3
1 Point

`right['C'] =`

4

Q4.4
1 Point

`right['D'] =`

6

Q4.5
1 Point

`right['E'] =`

-1

Q4.6
1 Point

`right['R'] =`

9

Q4.7
1 Point

Assume that the text string is `ABRAZADABRACADABRA`. What is the value of `j` (the index over the pattern string)? right before comparing the character `Z` in the text.

4

Q4.8
1 Point

Assume that the text string is `ABRAZADABRACADABRA`. What is the value of `i` (the index over the text string)? right before comparing the character `Z` in the text.

0

Q4.9
1 Point

Assume that the text string is `ABRAZADABRACADABRA`. What is the value of `j` (the index over the pattern string)? right after comparing the character `Z` in the text.

10

Q4.10
1 Point

Assume that the text string is `ABRAZADABRACADABRA`. What is the value of `i` (the index over the text string)? right after comparing the character `Z` in the text.

5

Q4.11
3 Points

For the pattern and text strings shown above, state and justify **using a drawing** how many total character comparisons must be done in order to match the pattern shown within the text string.

4.11.png Download

Homework 2

GRADED

STUDENT
Sushruti Bansod

TOTAL POINTS

27.5 / 37 pts

QUESTION 1

(no title) **5** / 5 pts

1.1 (no title) **1** / 1 pt

1.2 (no title) **1** / 1 pt

1.3 (no title) **1** / 1 pt

1.4 (no title) **1** / 1 pt

1.5 (no title) **1** / 1 pt

QUESTION 2

(no title) **3** / 6 pts

2.1 (no title) **2** / 2 pts

2.2 (no title) **1** / 1 pt

2.3 (no title) **0** / 2 pts

2.4 (no title) **0** / 1 pt

QUESTION 3

(no title) **9.5** / 13 pts

3.1 (no title) **1** / 1 pt

3.2 (no title) **1** / 1 pt

3.3 (no title) **1** / 1 pt

3.4 (no title) **1** / 1 pt

3.5 (no title) **1** / 1 pt

3.6 (no title) **1** / 1 pt

3.7 (no title) **0** / 1 pt

3.8 (no title) **0** / 1 pt

3.9 (no title) **2.5** / 3 pts

3.10 (no title) **0** / 1 pt

3.11 (no title) **1** / 1 pt

QUESTION 4

(no title) **10** / 13 pts

4.1 (no title) **1** / 1 pt

4.2 (no title) **1** / 1 pt

4.3 (no title) **1** / 1 pt

4.4 (no title) **1** / 1 pt

4.5 (no title) **1** / 1 pt

4.6 (no title) **1** / 1 pt

4.7 (no title) **1** / 1 pt

4.8 (no title) **1** / 1 pt

4.9 (no title) **1** / 1 pt

4.10 (no title) **1** / 1 pt

4.11 **(no title)** **0** / 3 pts

- **− 0 pts** Correct
- ✔ **− 3 pts** **Incorrect**
- **− 1.5 pts** Partial correct