

Name: \_\_\_\_\_

J#: \_\_\_\_\_

**Jackson State University**  
**CSC 323 Algorithm Design and Analysis, Fall 2016**  
**Instructor: Dr. Natarajan Meghanathan**  
**Exam 2 (Take Home Exam)**

**Maximum Points:** 100**Due on: November 1, 2016: 11.30 AM**Use additional sheets, if necessary. **You should staple your exam. Submit on-time at 11.30 AM**

1) (20 points) Construct a Huffman code for the following data (show all steps):

Student Name	Frequency of Symbols					Test Symbol Sequence
	A	B	C	D	E	
Kirubel Benalfew	0.21	0.35	0.16	0.08	0.20	BEAAEDDEBB
Yosef Getachew	0.34	0.12	0.07	0.37	0.10	AADADDECCD
Quavanti Hart	0.40	0.20	0.21	0.09	0.10	ACAAECEAEAB
Deonta Kilpatrick	0.25	0.20	0.28	0.15	0.12	BADBCDECBD
Kabinad Melaku	0.15	0.24	0.14	0.27	0.20	AEBBADCBE
Shawndon Portis	0.50	0.2	0.1	0.05	0.15	ACBDAABDAC
Nicholas Whitfield	0.45	0.18	0.19	0.07	0.11	BEBAAABCBA
Ladarius Felix	0.29	0.07	0.10	0.20	0.34	EEAEAEDEEE
Alishia Harmon	0.20	0.30	0.15	0.25	0.10	ABBCBAACBD
Algesa Haywood	0.35	0.30	0.12	0.20	0.03	AADADBCABB
Darius Leroy	0.10	0.16	0.54	0.12	0.08	BCCADCCCC
Michael Moore	0.44	0.22	0.11	0.04	0.19	AAABBEABEA
Karmeen Powell-Childress	0.28	0.27	0.15	0.14	0.16	ACEDDCBACA
Brian Williams	0.10	0.29	0.21	0.32	0.08	BBDBBADDCC

- (a) Determine the average number of bits per symbol.
- (b) Determine the generic compression ratio compared to fixed-length encoding.
- (c) Encode the given text symbol sequence using the Huffman code that you determined. Compute the compression ratio achieved for this text compared to fixed-length encoding.

Name: \_\_\_\_\_

J#: \_\_\_\_\_

Name: \_\_\_\_\_

J#: \_\_\_\_\_

2) (20 points) Draw a binary search tree for the following sorted array, and determine the average number of comparisons for a successful search and an unsuccessful search.

Student # / Name	Array
Kirubel Benalfew	[4, 8, 16, 26, 30, 33, 46, 64, 74, 95, 99]
Yosef Getachew	[16, 22, 40, 58, 60, 65, 68, 70, 75, 79, 89, 95]
Quavanti Hart	[22, 32, 41, 52, 56, 59, 69, 74, 79, 83, 89, 92, 99]
Deonta Kilpatrick	[3, 22, 30, 36, 49, 52, 64, 75, 89, 93, 96, 99]
Kabinad Melaku	[20, 23, 26, 29, 36, 40, 49, 54, 62, 69, 79, 88, 92]
Shawndon Portis	[5, 9, 12, 15, 19, 22, 30, 50, 54, 57, 78, 84, 94]
Nicholas Whitfield	[8, 14, 19, 34, 37, 40, 43, 46, 49, 54, 77, 87, 95]
Ladarius Felix	[3, 20, 28, 34, 41, 48, 54, 63, 84, 89, 97]
Alishia Harmon	[20, 26, 30, 42, 60, 66, 69, 73, 81, 87, 91]
Algesa Haywood	[5, 19, 23, 29, 33, 39, 51, 65, 70, 77, 83, 89, 95]
Darius Leroy	[27, 38, 47, 56, 60, 64, 68, 72, 78, 84, 89, 97]
Michael Moore	[4, 10, 16, 19, 25, 36, 45, 52, 55, 61, 69, 97]
Karmeen Powell-Childress	[12, 22, 27, 32, 40, 44, 49, 53, 63, 99]
Brian Williams	[1, 4, 7, 10, 13, 41, 66, 76, 81, 91, 96]

Name: \_\_\_\_\_

J#: \_\_\_\_\_

Name: \_\_\_\_\_

J#: \_\_\_\_\_

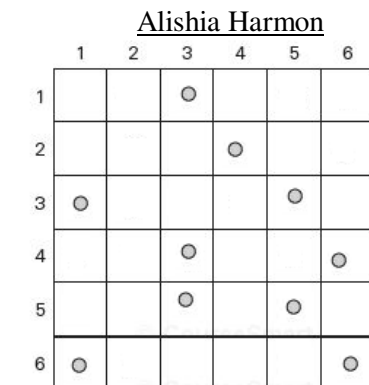
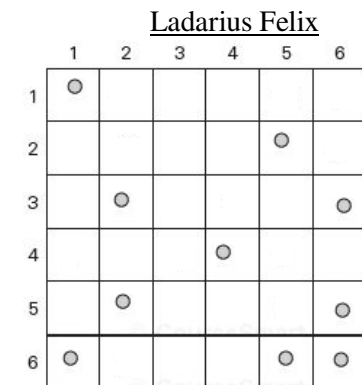
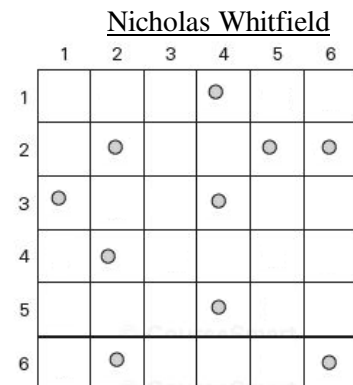
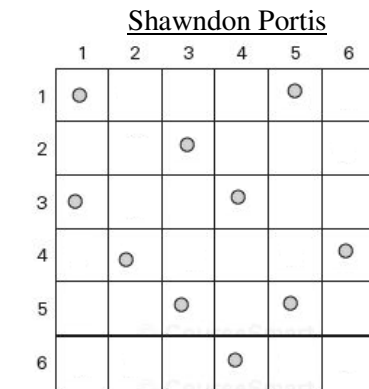
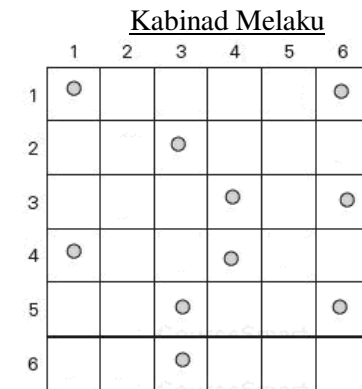
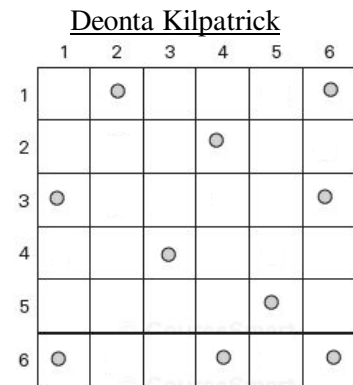
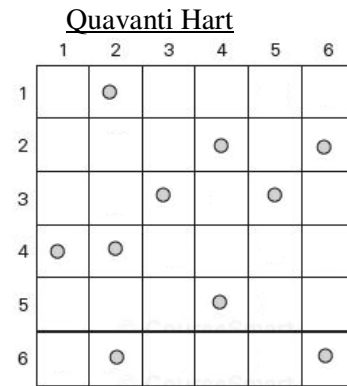
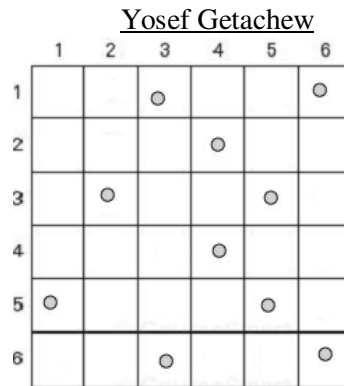
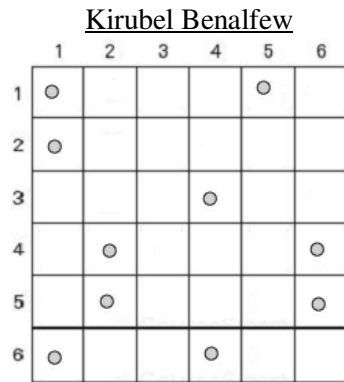
3) (10 points) Using Dynamic Programming, compute the binomial coefficient for the numbers assigned below. Show the table and all the work.

<b>Student # / Name</b>	<b>n</b>	<b>k</b>
Kirubel Benalfew	13	8
Yosef Getachew	10	7
Quavanti Hart	12	9
Deonta Kilpatrick	10	6
Kabinad Melaku	13	5
Shawndon Portis	13	10
Nicholas Whitfield	12	7
Ladarius Felix	11	7
Alishia Harmon	13	11
Algesa Haywood	10	4
Darius Leroy	11	9
Michael Moore	12	8
Karmeen Powell-Childress	11	5
Brian Williams	10	8

Name: \_\_\_\_\_

J#: \_\_\_\_\_

4) (15 points) Several coins are placed in cells of a 6 x 6 board ( $n \times m$  board) shown below for each student, with no more than one coin per cell. Assume the value of each coin is 1. Determine a path from cell (1, 1) to cell (6, 6) such that the path traced collects the maximum number of coins (also same as the maximum value of the coins).



Name: \_\_\_\_\_

J#: \_\_\_\_\_

Algesa Haywood

	1	2	3	4	5	6
1		●			●	
2		●				●
3			●			
4	●			●		
5					●	●
6			●			

Darius Leroy

	1	2	3	4	5	6
1				●		●
2		●			●	
3		●		●		
4	●				●	
5			●		●	
6				●		

Michael Moore

	1	2	3	4	5	6
1		●			●	
2			●			●
3	●			●		
4			●			●
5					●	
6	●		●			

Karmeen Powell

	1	2	3	4	5	6
1	●		●		●	
2	●					●
3		●		●		●
4			●		●	
5		●		●		
6			●			●

Brian Williams

	1	2	3	4	5	6
1			●		●	
2		●			●	
3	●			●		●
4			●		●	
5		●				●
6	●		●			

Name: \_\_\_\_\_

J#: \_\_\_\_\_



Name: \_\_\_\_\_

J#: \_\_\_\_\_

5) (15 points) Use the hashing technique to determine sub sequences of length 2 or more in the following array assigned to you. Show all the work (including the contents of the hash table as well as the different keys you are searching for) .

Student # / Name	Array
Kirubel Benalfew	[31, 8, 29, 90, 4, 9, 32, 7, 5, 33, 30, 89, 10]
Yosef Getachew	[94, 97, 99, 98, 91, 67, 101, 21, 92, 96, 100, 93, 32]
Quavanti Hart	[13, 10, 55, 89, 86, 81, 11, 90, 9, 93, 12, 98, 87]
Deonta Kilpatrick	[88, 40, 93, 43, 95, 39, 24, 26, 68, 94, 25, 42, 41]
Kabinad Melaku	[61, 21, 3, 99, 94, 22, 41, 73, 25, 71, 24, 95, 72]
Shawndon Portis	[26, 1, 6, 90, 7, 25, 8, 24, 0, 42, 43, 91, 44]
Nicholas Whitfield	[17, 40, 80, 81, 34, 70, 3, 19, 83, 18, 33, 2, 15]
Ladarius Felix	[41, 17, 6, 35, 60, 32, 31, 40, 7, 79, 33, 78, 34]
Alishia Harmon	[92, 60, 73, 81, 13, 14, 2, 12, 71, 80, 11, 1, 72]
Algesa Haywood	[81, 80, 17, 33, 68, 69, 34, 72, 77, 37, 32, 76, 73]
Darius Leroy	[12, 91, 45, 90, 11, 55, 1, 92, 89, 94, 93, 26, 10]
Michael Moore	[71, 43, 38, 37, 72, 82, 73, 34, 85, 83, 6, 7, 84]
Karmeen Powell-Childress	[75, 57, 93, 36, 74, 31, 62, 6, 76, 30, 29, 73, 37]
Brian Williams	[41, 33, 78, 76, 38, 75, 36, 77, 88, 35, 50, 34, 79]

Name: \_\_\_\_\_

J#: \_\_\_\_\_

Name: \_\_\_\_\_

J#: \_\_\_\_\_

6) (20 points) Let the hash function be  $H(K) = K \bmod 5$ . Given two sets A and B, the Jaccard Index of A and B,  $J(A, B)$  is defined as follows.

$$J(A, B) = \frac{|A \cap B|}{|A \cup B|}$$

- (a) Design a hash table based algorithm to determine the intersection of two sets A and B. Write the pseudo code.
- (b) Show the execution of the algorithm in (a) on the sets A and B assigned to you and determine the intersection of the two sets. Determine the total number of comparisons encountered.
- (c) Design a hash table based algorithm to determine the union of two sets A and B. Write the pseudo code.
- (d) Show the execution of the algorithm in (c) on the sets A and B assigned to you and determine the union of the two sets. Determine the total number of comparisons encountered.
- (e) Use the formula shown above to determine the Jaccard Index of the two sets A and B assigned to you.

Student # / Name	Set A	Set B
Kirubel Benalfew	[20, 21, 18, 13, 14, 19]	[11, 20, 15, 21, 19, 18]
Yosef Getachew	[17, 16, 18, 13, 15, 14]	[13, 15, 20, 21, 10, 14]
Quavanti Hart	[19, 21, 23, 22, 20, 18]	[20, 10, 14, 21, 17, 19]
Deonta Kilpatrick	[14, 15, 12, 20, 18, 16]	[19, 18, 14, 10, 15, 17]
Kabinad Melaku	[19, 13, 10, 14, 18, 17]	[14, 19, 15, 18, 20, 17]
Shawndon Portis	[16, 15, 20, 17, 18, 19]	[14, 15, 16, 17, 21, 20]
Nicholas Whitfield	[13, 14, 16, 12, 18, 17]	[11, 10, 18, 12, 15, 17]
Ladarius Felix	[18, 14, 16, 13, 17, 15]	[12, 21, 10, 18, 11, 20]
Alishia Harmon	[14, 11, 16, 12, 20, 13]	[21, 20, 16, 19, 15, 18]
Algesa Haywood	[15, 11, 10, 14, 16, 19]	[15, 11, 16, 20, 18, 19]
Darius Leroy	[19, 20, 15, 17, 16, 18]	[17, 20, 15, 19, 21, 16]
Michael Moore	[15, 13, 16, 17, 10, 20]	[16, 17, 18, 12, 20, 11]
Karmeen Powell-Childress	[14, 16, 19, 18, 20, 21]	[15, 13, 10, 14, 11, 17]
Brian Williams	[12, 20, 14, 11, 13, 19]	[17, 14, 20, 19, 15, 16]

Name: \_\_\_\_\_

J#: \_\_\_\_\_