Name: _____ J#: _____

Jackson State University
CSC 323 Algorithm Design and Analysis, Spring 2017
Instructor: Dr. Natarajan Meghanathan
Exam 2 (Take Home Exam)

Maximum Points: 100 **Due on: March 23, 2017: 1 PM**

Use additional sheets, if necessary.

You should staple your exam. Submit on-time at 1 PM. There will NOT be any postponement

1) (30 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	
Alexander Arrington	0.21	0.35	0.16	0.08	0.20	BEAAEDDEBB
Jaylen Boykin	0.34	0.12	0.07	0.37	0.10	AADADDECCD
Jason Bruno	0.40	0.20	0.21	0.09	0.10	ACAAECEAEB
Elbert Buchanan	0.25	0.20	0.28	0.15	0.12	BADBCDECBD
Daniel Epps	0.15	0.24	0.14	0.27	0.20	AEBBADCBEE
Jordan Hubbard	0.50	0.2	0.1	0.05	0.15	ACBDAABDAC
Kayla Johnson	0.45	0.18	0.19	0.07	0.11	BEBAAABCBA
Bria McCutcheon	0.29	0.07	0.10	0.20	0.34	EEAEAEDEEE
Darren McGee	0.20	0.30	0.15	0.25	0.10	ABBCBAACBD
Justin McGuffee	0.35	0.30	0.12	0.20	0.03	AADADBCABB
Kayshaunna Williams	0.10	0.16	0.54	0.12	0.08	BCCADCCCCC
Michael Wilson	0.44	0.22	0.11	0.04	0.19	AAABBEABEA

(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#: _____

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2) (45 points) The binomial coefficient C(n, k) can be calculated using the recurrence relation:

C(n, k) = C(n-1, k) + C(n-1, k-1) for 0 < k < n
C(n, 0) = 1 for any n = 0 to n.
C(k, k) = 1 for any k = 0 to n.

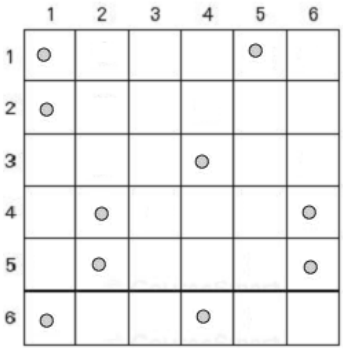
Write an iterative program to compute the binomial coefficient C(n, k) using the recurrence relation and the basic conditions given above.
As part of your answer, you are required to include the complete program code as well as a screenshot of the output for the n and k values assigned to you.

Student # / Name	**n**	**k**
Alexander Arrington	13	8
Jaylen Boykin	10	7
Jason Bruno	12	9
Elbert Buchanan	10	6
Daniel Epps	13	5
Jordan Hubbard	13	10
Kayla Johnson	12	7
Bria McCutcheon	11	7
Darren McGee	13	11
Justin McGuffee	10	4
Kayshaunna Williams	11	9
Michael Wilson	12	8

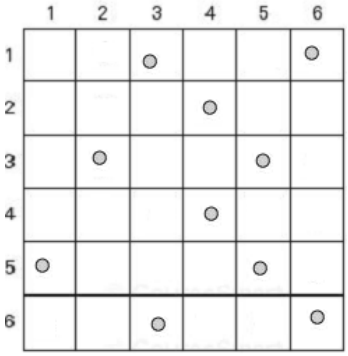
Name: _____ J#: _____

3) (20 points) Several coins are placed in cells of a 6 x 6 board (*n* x *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).

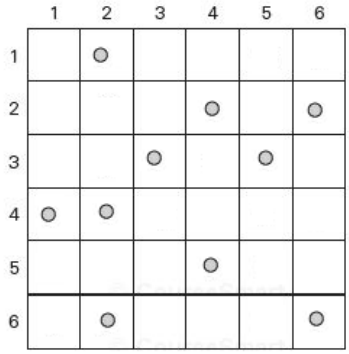
Alexander Arrington



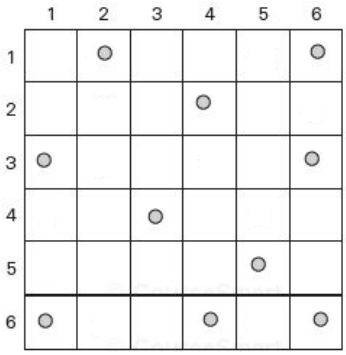
Jaylen Boykin



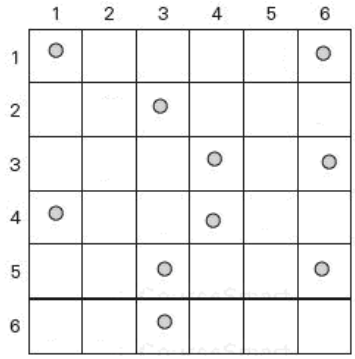
Jason Bruno



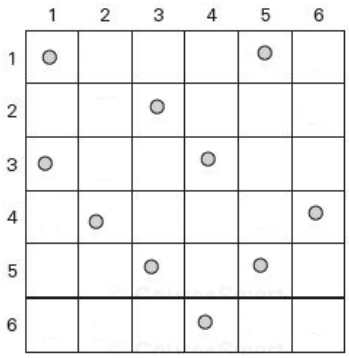
Elbert Buchanan



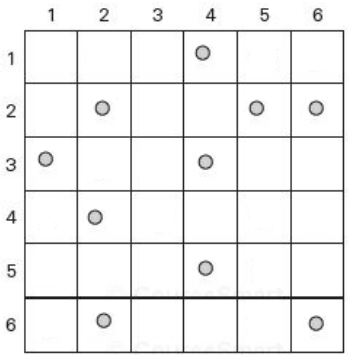
Daniel Epps



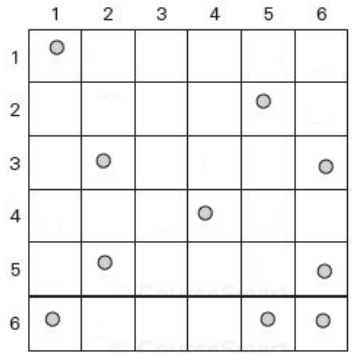
Jordan Hubbard



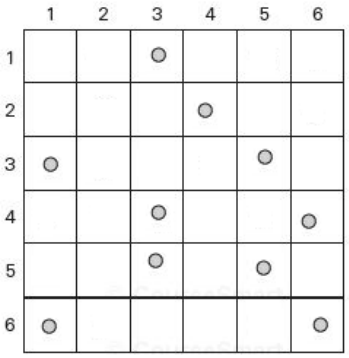
Kayla Johnson



Bria McCutcheon

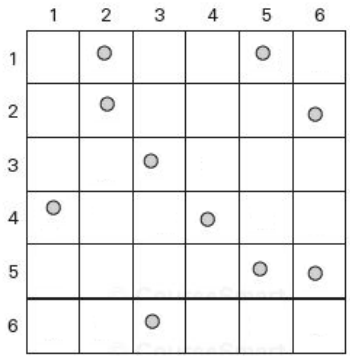


Darren McGee

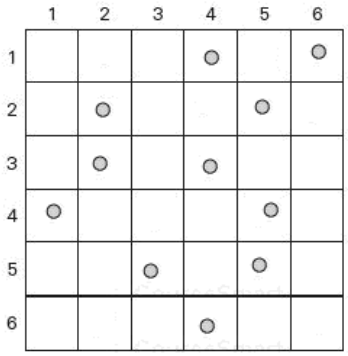


Name: _____ J#: _____

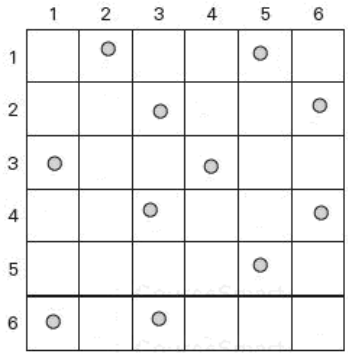
Justin McGuffee



Kayshaunna Williams



Michael Wilson



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5) (25 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**
Alexander Arrington	[31, 8, 29, 90, 4, 9, 32, 7, 5, 33, 30, 89, 10]
Jaylen Boykin	[94, 97, 99, 98, 91, 67, 101, 21, 92, 96, 100, 93, 32]
Jason Bruno	[13, 10, 55, 89, 86, 81, 11, 90, 9, 93, 12, 98, 87]
Elbert Buchanan	[88, 40, 93, 43, 95, 39, 24, 26, 68, 94, 25, 42, 41]
Daniel Epps	[61, 21, 3, 99, 94, 22, 41, 73, 25, 71, 24, 95, 72]
Jordan Hubbard	[26, 1, 6, 90, 7, 25, 8, 24, 0, 42, 43, 91, 44]
Kayla Johnson	[17, 40, 80, 81, 34, 70, 3, 19, 83, 18, 33, 2, 15]
Bria McCutcheon	[41, 17, 6, 35, 60, 32, 31, 40, 7, 79, 33, 78, 34]
Darren McGee	[92, 60, 73, 81, 13, 14, 2, 12, 71, 80, 11, 1, 72]
Justin McGuffee	[81, 80, 17, 33, 68, 69, 34, 72, 77, 37, 32, 76, 73]
Kayshaunna Williams	[12, 91, 45, 90, 11, 55, 1, 92, 89, 94, 93, 26, 10]
Michael Wilson	[71, 43, 38, 37, 72, 82, 73, 34, 85, 83, 6, 7, 84]

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6) (30 points) Given the sequences below, find the longest common sub sequence using the dynamic programming formulation discussed in class. Show the table and all the work. Also, show the final sequence alignment along with the gaps in both the sequences, if any.

1	Alexander Arrington	GACGAAC	GACGGGCT
2	Jaylen Boykin	CTTCAGCAG	ACCCGAGA
3	Jason Bruno	CTAAGCTTT	TATTCTGCA
4	Daniel Epps	TGCGTGCAG	GGGTTC
5	Jordan Hubbard	ATCCTT	ACAAGAA
6	Kayla Johnson	GGGTCGA	CCGCGTC
7	Bria McCutcheon	TCATGGATT	AAACTC
8	Darren McGee	TTCCGTAA	ACGGTTGCT
9	Justin McGuffee	ATAAGAGC	CTTACAGC
10	Elbert Buchanan	TCACGGT	AAATTG
11	Kayshaunna Williams	GGTACGGT	TCTGCT
12	Michael Wilson	TTTCTCGTA	AGACCTAGA

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