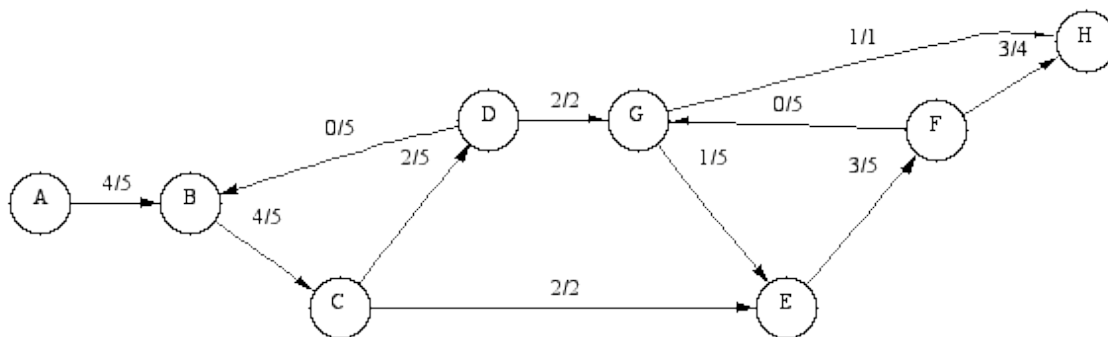


# Final

Due June 10, 2015 at 11:59 pm  
Submit to marc.soriano@rcc.edu

## Multiple Choice/Quick Calculation [2 point each]

1. If there are 4 different ways to go from LA to Riverside and 3 different ways to go from Riverside to Temecula, how many different ways are there to go from LA to Temecula through Riverside?
2. Assume you have a hamper full of 4 types of socks. How many socks do you need to pull out to guarantee you will have a matching pair?
  - a) 2
  - b) 3
  - c) 4
  - d) 5
  - e) 6
3. Assume you are dealing with the serial number format AA### (two capital letters followed by 3 numbers). How many different serial numbers can be generated from the given format?
4. Given the following directed graph, indicate which nodes are sinks and which are sources



5. Assuming you are using a fair coin, what is the probability of flipping and getting 3 consecutive heads?
6. Assuming you are using a weighted coin that gives you a 0.51 chance of flipping heads and a 0.49 chance of flipping tails, what is the probability of flipping and getting 3 consecutive heads?

7. Assume you are given a binary tree of height 8. What is the maximum number of nodes that tree might contain?
- a) 127
  - b) 128
  - c) 255
  - d) 256
  - e) 511
  - f) 512

**Using the Grey Matter a Little Bit [4 points each]**

8. Assume you have 52 cards in a deck, and you have to draw 10 cards. Assuming you have to put back the card after each draw, what is the probability that you will not draw any repeated cards? What is the probability that you will draw at least one repeated card?

9. You sneak into a super-secret facility see a security keypad with the inputs 0 –9 (see figure below). Observing a guard, you notice that the correct key code to open the door consists of 4 digits.



- a) Knowing nothing else, how many key codes would you potentially have to test to gain entry?
- b) You notice that keys for 1, 2, 3, and 4 are slightly worn out, leading you to believe those are the 4 digits used for the key code. Knowing this additional piece of information, how many key codes would you potentially have to test to gain entry?
- c) You come up to another keypad with the same setup, but notice the keys for 7, 8, and 9 are slightly worn out. Assuming those are the only numbers used for a 4 digit key code, how many key codes would you potentially have to test to gain entry?

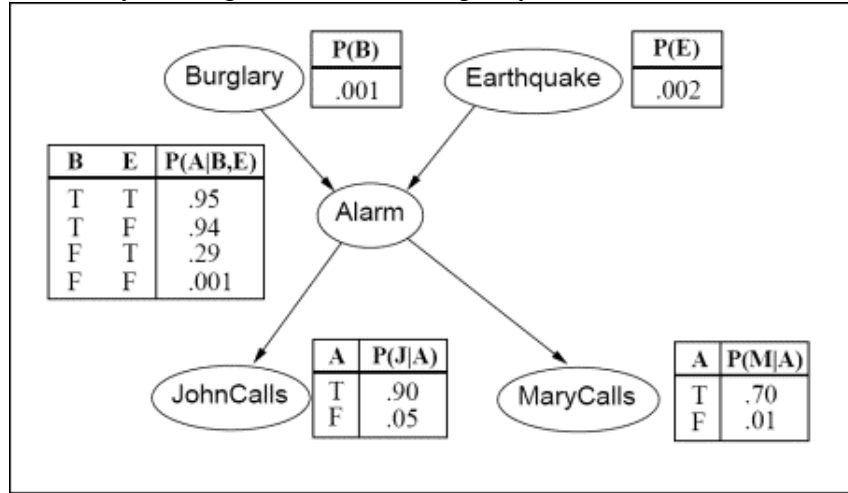
10. Assume you have a Mars rover that can move right a single unit with a probability of  $P(M) = 0.6$   
Given the following initial probability distribution at  $t=0$

1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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What is the probability distribution after 5 steps? (i.e.  $t=5$ )

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11. Assume you are given the following Bayesian Network for an alarm system owned by John and Mary.



Determine the probability that either John or Mary will call the police with their dependence on the alarm marginalized out. (Hint: Determine  $P(A)$  first then apply to find  $P(J) + P(M)$ )

### Draw Something! [4 point each]

12. Draw and label a corresponding graph given the following weighted adjacency matrix (disconnected edges are labeled with  $\infty$ ).

	A	B	C	D	E	F	G	H	I
A	$\infty$	1.0	$\infty$	1.5	$\infty$	$\infty$	$\infty$	$\infty$	$\infty$
B	1.0	$\infty$	1.0	$\infty$	1.0	$\infty$	$\infty$	$\infty$	$\infty$
C	$\infty$	1.0	$\infty$	$\infty$	$\infty$	1.0	$\infty$	$\infty$	$\infty$
D	1.5	$\infty$	$\infty$	$\infty$	2.0	$\infty$	1.5	$\infty$	$\infty$
E	$\infty$	1.0	$\infty$	2.0	$\infty$	1.0	$\infty$	1.0	$\infty$
F	$\infty$	$\infty$	1.0	$\infty$	1.0	$\infty$	$\infty$	$\infty$	1.5
G	$\infty$	$\infty$	$\infty$	1.5	$\infty$	$\infty$	$\infty$	1.0	$\infty$
H	$\infty$	$\infty$	$\infty$	$\infty$	1.0	$\infty$	1.0	$\infty$	2.0
I	$\infty$	$\infty$	$\infty$	$\infty$	$\infty$	1.5	$\infty$	2.0	$\infty$

13. Draw and label a corresponding graph given the following weighted adjacency list

	(adj, weight)
A	(D, 1), (E, 1.5)
B	(E, 1), (F, 1.5)
C	(F, 1)
D	(A, 1), (E, 1), (G, 1), (H, 1.5)
E	(A, 1.5), (B, 1), (D, 1), (F, 1), (H, 1), (I, 1.5)
F	(B, 1.5), (C, 1), (E, 1), (I, 1)
G	(D, 1), (H, 1)
H	(D, 1.5), (E, 1), (G, 1), (I, 1)
I	(E, 1.5), (F, 1), (H, 1)

14. Determine the minimum spanning trees for the graphs in problem 12 and 13

### Programming Challenge [8 point each]

15. [Sets]

- ❖ Come up with an algorithm to find all sets of size 4 of unique numbers between 1 and 100 that sum up to 100.

Example: if  $n=3$ , find all sets of 3 numbers between 1 and 100 that add up to 100

Partial Solution: {1, 2, 97}, {1, 3, 96}, {1, 4, 95}, {1, 5, 94}, ...

- ❖ Come up with an algorithm to find all sets of non-repeating numbers between 1 and 100 that sum up to 100. What is the total number of sets?

### 16. [What a Tall Tree]

Develop a recursive algorithm to determine the height of a binary tree. Each node might have a left or right child, they will be assigned to NULL if they do not exist. (8 points)

```
struct Node
{
    Node* left;
    Node* right;
};

//fill in your code here!
int Height(Node* n)
{

```

```
}
```

### 17. [Is It a Tree?]

Write an algorithm that given an undirected adjacency matrix determines if the resulting graph is a tree or not. (Alternative: determine if the graph contains any cycles) See the given files for test examples.