## Q1 Probabilistic Inference
**10 Points**

Your box of cereal may be a contest winner! It's rattling, which 100% of winning boxes do. Of course 1% of all boxes rattle and only one box in a million is a winner. What is the probability that your box is a winner?

Note on answer formatting: Please specify your answer as a decimal probability (i.e. .05 rather than 5%). Do not include zeros before the decimal. To receive credit, your answer must match ours exactly.

.0001

## Q2 Events
**14 Points**

You are playing a solitaire game in which you are dealt three cards without
replacement from a simplified deck of 10 cards (marked 1 through 10). You win if
one of your cards is a 10 or if all of your cards are odd.

How many winning hands are there if different orders are different hands?

276

What is your chance of winning? (round your answer to 3 decimal places)

.383

## Q3 Expectations
**18 Points**

Someone rolls a fair six-sided die and you win points equal to the number shown.

What is
the expected number of points after one roll?

3.5

After 2 rolls?

7

After 100 rolls?

350

**Q4 Conditional Probabilities**
**13 Points**

Select all of the following statements that are true for all joint distributions over
$X$ and $Y$.

- [ ] $P(x, y) = P(x)P(y)$
- [x] $P(x, y) = P(x \mid y)P(y)$
- [ ] $P(x, y) = P(x \mid y)P(y \mid x)$
- [ ] $P(x) = \sum_y P(x \mid y)$
- [x] $P(x) = \sum_y P(x, y)$
- [ ] None of the above.

## Q5 Linear Equations
**14 Points**

You know that $x = \left(\frac{1}{2}\right) y + \left(\frac{1}{2}\right)(x+1)$ and $y = \left(\frac{1}{3}\right) y + \left(\frac{1}{3}\right)(x+2)$.

What is x?

4

What is y?

3

## Q6 Logarithms
**13 Points**

Select all of the the following statements that are true.

- [ ] $2^{(x*y)} = 2^x 2^y$
- [x] $2^{(x+y)} = 2^x 2^y$
- [ ] $2^{(x+y)} = 2^x + 2^y$
- [ ] $\log(3^x) = \log(3)\log(x)$
- [x] $\log(3^x) = x\log(3)$
- [ ] $\log(3^x) = 3x$
- [ ] None of the above.

## Q7 Hashing
**18 Points**

**Q7.1**
**6 Points**

Which critical operation is generally faster in a hash table than in a linked
list?

- inserting an element into the data structure
- testing for the membership of an element in the data structure

**Q7.2**
**6 Points**

On average, how fast is this operation in a hash table?

- $O(1)$
- $O(n)$
- $O(\log n)$
- $O(n^2)$
- None of the above.

**Q7.3**
**6 Points**

On average, how fast is this operation in a linked list?

$O(1)$

$O(n)$

$O(\log n)$

$O(n^2)$

None of the above.

## Homework 0

● Graded

**Student**

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**Total Points**

**100 / 100 pts**

**Question 1**

Probabilistic Inference — **10** / 10 pts

**Question 2**

Events — **14** / 14 pts

**Question 3**

Expectations — **18** / 18 pts

**Question 4**

Conditional Probabilities — **13** / 13 pts

**Question 5**

Linear Equations — **14** / 14 pts

**Question 6**

Logarithms — **13** / 13 pts

**Question 7**

| | | |
|---|---|---|
| Hashing | | **18** / 18 pts |
| **7.1** | (no title) | **6** / 6 pts |
| **7.2** | (no title) | **6** / 6 pts |
| **7.3** | (no title) | **6** / 6 pts |