Quiz 4

Started: Feb 7 at 7:42pm

Quiz Instructions

Question 1 — 1 pts

Choose the strongest statement (from among the following options) for the following hash family.

	a	b	c
h_1	0	0	0
h_2	1	0	1
h_3	0	1	1
h_4	1	1	0

- ○ Universal
- ○ 1-Universal
- ○ Universal and 1-Universal but not 2-universal
- ◉ 2-universal
- ○ 3-universal

Question 2 — 1 pts

Choose the strongest statement (from among the following options) for the following hash family.

	a	b	c
h_1	0	0	0
h_2	1	0	1
h_3	0	1	1
h_4	0	0	1

- ○ universal
- ○ 1-universal
- ◉ universal and 1-universal but not 2-universal
- ○ 2-universal
- ○

3-universal

Question 3 — 1 pts

Suppose you have a hash family H that is 3-universal, and it contains hash functions that map $\{0, 1, 2, \ldots, n-1\}$ to $\{1, 2, \ldots, n\}$.

True or False: the number of distinct functions in H can be $O(n^2)$.

- ○ True
- ◉ False

Question 4 — 1 pts

We saw for a **fixed** dictionary S of size N, we can construct a hash function h so that all query operations take constant time, assuming universal hash functions can be evaluated in $O(1)$ time.

True or False: this function h can be found in $O(N)$expected time.

- ◉ True
- ○ False

Question 5 — 1 pts

In the streaming lecture, we saw a deterministic algorithm to return the majority element in a stream of length n (if one exists), based on incrementing and decrementing counters. Each element belongs to a universe Σ.

Which of the following statements is true about this algorithm?

- ◉ Can return false positives
- ○ Can return false negatives
- ○ Can return both false positives and false negatives
- ○ Uses storage of size $\Omega(n)$
- ○ Uses storage of size $\Omega(|\Sigma|)$

Question 6 — 1 pts

We also saw a randomized algorithm to maintain heavy hitters in a stream given both inserts and deletes. Given an element e, this algorithm returns an estimate $est(e)$.

Which of the following statements are always true about this estimate?

- ○ The estimate is an under-estimate
- ◉ The estimate is an over-estimate
- ○ The estimate can sometimes be an under-estimate, and sometimes an over-estimate

Question 7 — 0.5 pts

In the Karp-Rabin algorithm, suppose we have a text of length m, and want to find a string of length n.

After we pick the random prime, what is the tightest bound of the runtime of this algorithm?

- ○ $O(\lg(m) + \lg(n))$
- ◉ $O(m + n)$
- ○ $O(n \log(m))$
- ○ $O(m \log(n))$
- ○ $O(mn)$

Question 8 — 0.5 pts

The Karp-Rabin algorithm may yield which of the following:

- ◉ false positives
- ○ false negatives

Question 9 — 1 pts

Given an n-bit number x, the number of **distinct** prime divisors of x is at most what? (Pick the smallest correct upper bound from among the following options)

- ○ $\lg \lg n$
- ○ $\lg n$
- ◉ n
- ○ n^2
- ○ 2^n

Question 10

1 pts

Given any number x in the range $\{2, 3, \ldots, n\}$, the number of **distinct** prime divisors of x is at most what? (Pick the smallest correct upper bound from among the following options)

- ○ $\lg \lg n$
- ◉ $\lg n$
- ○ n
- ○ n^2
- ○ 2^n

Question 11

1 pts

Given an n-bit number x, we want to check whether x is a prime or not. One algorithm is to first check that x is 2 or not, and then for each odd number y in the range $[3..\lfloor\sqrt{x}\rfloor]$, check that y is not a divisor of x.

True or false: This algorithm runs in time polynomial in the number of bits n.

- ○ True
- ◉ False

No new data to save. Last checked at 8:44pm

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