**CacheEntry.access**

Inputs: *count*, *accesses, time*

Equivalence classes:

*count*: <0, 0, 1, 9, 10, INT\_MAX

*accesses(time)*: 0 access, 1 accesses, 9 accesses, 10 accesses, > 10accesses

*time*: <0, >= 0

Test cases:

(1). count < 0, 0 access, time < 0.

(2). count = INT\_MAX, 0 access, time >= 0.

(2). count = 0, 0 access, time >= 0.

(3). count = 1, 1 access, time >= 0.

(4). count = 9, 9 accesses, time >= 0.

(5). count = 10, 10 accesses, time >= 0.

(6). count = 12, 12 accesses, time >= 0.

Bugs:

1. Allows variable *count* to be negative, no IllegalStateException thrown.
2. Allows variable *time* to be negative, no IllegalArgumentException thrown.
3. count may overflow.

**Cache.remove**:

Input: *key*, *entries*

Equivalence classes:

*key*: null, existing key, non-existing key

*entries*: 0 entry, 1 entry, someSize entries, fullSize -1 entries, fullSize entries.

Test cases:

(1). Key = null, 0 entry.

(2). Key = existing key, 1 entry.

(3). Key = existing key, fullSize-1 entries

(4). Key = non-existing key, fullSize entries.

(5). Key = non-existing key, 3 entries.

Bugs:

1. When cacheEntry is not full size, call remove() with a non-existing key will result in getting an NullPointerException.

**Cache.hitRate**

Input: *hits*, *misses*

Equivalence classes:

*Hits*: < 0, 0, > 0 INT\_MAX

*Misses*: <0, 0, >0, INT\_MAX

Test cases:

(1). hits = INT\_MAX, misses = INT\_MAX

(2). hits = 0, misses = 0

(3). hits = -1, misses = 1

(4). hits = 1, misses = -1

(5). hits = 3, misses = 5

(6). hits = 1, misses = 0

Bugs:

1. When cache is just initialized, that is, *hits* is 0 and *misses* is 0, the if we call hitRate() and NaN result is returned.
2. When *hits* is negative and *misses* is positive, no IllegalStateException is thrown.
3. When *misses* is negative and *hits* is positive, no IllegalStateException is thrown.
4. When hits or misses is INT\_MAX, or when hits + misses causes overflow, no IllegalStateException is thrown.
5. When misses and hits are positive, the result of hitRate() is not correct.

**Cache.growCache**

Input: *entries*, *initialSize*

Equivalence classes:

*initialSize*: <0, 0, >0, INT\_MAX

*entries*: 0 entry, some entries, fullSize-1 entries, fullSize entries.

Test cases:

(1). initialSize = -10, 0 entry.

(2). initialSize = 0, 0 entry.

(3). initialSize = 8, 1 entry.

(4). initialSize = INT\_MAX, 7 entry.

(5). initialSize = 8, 8 entry.

(6). initialSize = 8, 7 entry.

Bugs:

1. When initialSize is negative, no appropriate exception message is thrown.
2. When initialSize of cacheEntry is positive, the call of growCache() does not increase the size of cacheEntry array.
3. growCache() does not handle the case of overflow(cacheEntry.length + initialSize).

**Cache.mostPopularKey**:

Input: *history*

Equivalence classes:

*history*: empty, one Popular Key, multiple Popular Keys

Test cases:

(1). Empty history.

(2). One popular key = “test”

(3). Two popular key: “test1”, “test2”

(4). First last key the same, others different

Bugs:

1. No bugs are found

**LRUCache.replace**

Input: *entries*

Equivalence classes:

*entries*: empty, 1 entry, some entries, fullSize entries(1. No tie in most recent, 2.ties in most recent)

Test cases:

(1). Empty entry.

(2). one entry.

(3). Some entries.

(4). Full size entries(no tie).

(5). Full size entries(tie).

Bugs:

1. When cache entries is full, the call of replace() does not return the least resent visited entry correctly

**LFUCache.replace**

Input: *entries*

Equivalence classes:

*entries*: empty, one entry, some entries, fullSize entries (tie or not tie)

Test cases:

(1). Empty entry.

(2). one entry.

(3). Some entries.

(4). Full size entries(no tie).

1. least frequent entry is the first entry

2. least frequent entry is the last entry

3. least frequent entry is in other slots

(5). Full size entries(tie).

Bugs:

1. When cache entries is full, the call of replace() does not return the least resent visited entry correctly

**RandomCache.replace**

Input: *entries*

Equivalence classes:

*entries*: empty, one entry, some entries, fullSize entries

Test cases:

(1). Empty entry.

(2). one entry.

(3). Some entries.

(4). Full size entries

Bugs:

1. No bugs are found.

Get()

Input: key, hits, misses, entries, history

Part2:

Bugs:

1. When call get() with null key, the expected result is false, but a NullPointerException is thrown.
2. When call get() with an existing key, the “key” field in the returned CacheResult is not set to the existing key but is set to null.