CISS350: Data Structures and Advanced Algorithms
Quiz q10801

Name: YOUR EMAIL Score:

For the following questions, the following is how you describe a hashtable. Suppose you have a collection of information on people t-shirt size:

```
John, L
Mary, L
Sue, S
Tom, XL
```

and you are using a table of size 5, and the mod 5 values of the hash of John, Mary, Sue, Tom are 1, 0, 2, 4, you write you write

```
[0, Not-Available, Mary, L]
[1, Not-Available, John, L]
[2, Not-Available, Sue, S]
[3, Available, None, None]
[4, Not-Available, Tom, XL]
```

The first column is the index value, the second is the hashtable row flag which must be Available, Not-Available, or Deleted, and third column is the key (the person's name), and the fourth column is the t-shirt size. The flag for each row must be set to one of the above three values. The key column and value column (third and fourth column) are initialized to None. If there's collision, linear probing is used.

TURN PAGE ...

Q1. You work for NSA. A message in characters a, b, c, d, e, f, g, h has been encrypted into 4-bit codes, i.e., each 4-bit sequence corresponding to one of the characters a, b, c, d, e, f, g, h. You do know the frequencies of a, b, c, d, e, f, g, h for the original message. For instance c is the most commonly occurring character. So you want to build a frequency table. Here's an example:

```
0000, 5
0010, 6
0100, 3
0110, 8
1000, 10
1011, 12
0111, 3
```

In this example 0000 occurs 5 times in the message, 0010 occurs 6 times in the message, etc. The above are the only possible 4-bit patterns in the message. Create a hashtable to build the frequency table of the following message:

$$0010, 0000, 0100, 0110, 0111, 0010, 0000, 1000, 0100, 1011, 0111, 0100, 1000$$

Assume the hash function on those bit patterns give you the following:

```
key   hash(key)
0000  12
0010  3
0100  7
0110  15
1000  22
1011  12
0111  42
```

and assume that you are using a hashtable of size 20. Write down the resulting hashtable.
Answer:

Q2. In the above, how many collisions did you encounter?
Answer:

Q3. Which key search will result in the longest chain of probes? If there's more than one, write down all the bit patterns separated by comma.
Answer:

Q4. You have just been informed that the message was corruped during transmission.

All the 0000 should have been 0110. Write down the resulting new hashtable.
Answer:

Instructions

In the file `thispreamble.tex` look for

```
\renewcommand\AUTHOR{}
```

and enter your email address:

```
\renewcommand\AUTHOR{jdoe5@cougars.ccis.edu}
```

(This is not really necessary since alex will change that for you when you execute `make`.) In your bash shell, execute "`make`" to recompile `main.pdf`. Execute "`make v`" to view `main.pdf`.

Enter your answers in `main.tex`. In the bash shell, execute "`make`" to recompile `main.pdf`. Execute "`make v`" to view `main.pdf`.

For each question, you'll see boxes for you to fill. For small boxes, if you see

```
1 + 1 = \answerbox{}.
```

you do this:

```
1 + 1 = \answerbox{2}.
```

`answerbox` will also appear in "true/false" and "multiple-choice" questions.

For longer answers that need typewriter font, if you see

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
\end{answercode}
```

you do this:

```
Write a C++ statement that declares an integer variable name x.
\begin{answercode}
int x;
\end{answercode}
```

`answercode` will appear in questions asking for code, algorithm, and program output. In this case, indentation and spacing is significant. For program output, I do look at spaces and newlines.

For long answers (not in typewriter font) if you see

```
What is the color of the sky?
\begin{answerlong}
\end{answerlong}
```

you can write

```
What is the color of the sky?
\begin{answerlong}
The color of the sky is blue.
\end{answerlong}
```

A question that begins with "T or F or M" requires you to identify whether it is true or false, or meaningless. "Meaningless" means something's wrong with the question and it is not well-defined. Something like "$1 + 2 = 4$" is either true or false (of course it's false). Something like "$1+_2 = 4$?" does not make sense.

When writing results of computations, make sure it's simplified. For instance write 2 instead of $1 + 1$.

Higher level classes.

For students beyond 245: You can put LaTeX commands in `answerlong`.

More examples of meaningless statements: Questions such as "Is $42 = 1+_2$ true or false?" or "Is $42 = \{2\}^{\{3\}}$ true or false?" does not make sense. "Is $P(42) = \{42\}$ true or false?" is meaningless because $P(X)$ is only defined if X is a set. For "Is $1 + 2 + 3$ true or false?", "$1 + 2 + 3$" is well–defined but as a "numerical expression", not as a "proposition", i.e., it cannot be true or false. Therefore "Is $1 + 2 + 3$ true or false?" is also not a well-defined question.

More examples of simplification: When you write down sets, if the answer is $\{1\}$, do not write $\{1, 1\}$. And when the values can be ordered, write the elements of the set in ascending order. When writing polynomials, begin with the highest degree term.

When writing a counterexample, always write the simplest.