CISS350: Data Structures and Advanced Algorithms
Quiz q10703

Name: YOUR EMAIL Score:

The following is the node for the prefix tree (or trie) from our notes.

```
class TrieNode
{
public:
    char flag;
    TrieNode * v[26];
};
```

The number of bytes used by such a node is 216. A pointer consumes 8 bytes.

Q1. Complete the function below to insert a word into the prefix tree.
Answer:

```
void insert(TrieNode ** p, const std::string & word)
{
}
```

Q2. Complete the function below to search for a word in the prefix tree.
Answer:

```
bool is_found(TrieNode * p, const std::string & word)
{
}
```

Q3. Recall from the notes that when you delete a word, you might be able to reclaim the memory of some nodes. For instance if `catch` is in the prefix tree and there is no word containing `catch` as a prefix and the longest prefix `catch` that is a word is `cat`, then when you want to remove `catch`, you can remove the nodes corresponding to the `c` and the `h`. But you can also do a "lazy delete": you don't reclaim the nodes but set a relevant flag to `' '`. Complete the following function to perform a lazy word delete from the prefix tree.
Answer:

```
void lazy_delete(TrieNode * p, const std::string & word)
{
}
```

Q4. Suppose the following are valid words: `a`, `aa`, `aaa`. The first word uses 2 bytes (including `'\0'`) for the data and also 8 bytes for a pointer to this string. The second word uses 3 bytes and 8 bytes for a pointer to this string. The third word uses 4 bytes and 8 bytes for a pointer to this string. So the total number of bytes used to describe the above 3 words when stored as an array of pointers to C-strings is $2+3+4+3\times 8$ bytes. Of course you also have to point to the first pointer of this data structure. So you need $2+3+4+3\times 8+8$ bytes. Altogether, how many bytes are used to store `a`, `aa`, `aaa`, ... up to a string of 1000 `a`'s?
Answer:

Q5. Refer to the previous question. If you use our prefix tree to store `a`, `aa`, `aaa`, ... up to a string of 1000 `a`'s, how many bytes are used by the prefix tree together with a pointer to the root of the tree?
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.