CISS350: Data Structures and Advanced Algorithms
Quiz q10302

Name: YOUR EMAIL Score:

For big-O, your answer should be of the form $O(n^k)$ for $k = 0, 1, 2, 3, ...$ Of course $O(n^0)$ is $O(1)$.

The next few questions below refer to our standard insertionsort.

Q1. Write down the array $\{5, 3, 1, 4, 2\}$ after two passes.
Answer:

$\{?, ?, ?, ?, ?\}$

Q2. For $\{5, 3, 1, 4, 2\}$, how many comparisons were made when the sorting ends?
Answer:

?

Q3. What array of size 5 with values 1,2,3,4,5 (in some order) will cause the algorithm to run with the highest wallclock time?
Answer:

$\{?, ?, ?, ?, ?\}$

Q4. What array of size 5 with values 1,2,3,4,5 (in some order) will cause the algorithm to run with the lowest wallclock time?
Answer:

$\{?, ?, ?, ?, ?\}$

Q5. Is it stable? Write YES, or write NO and then write down the simplest array of smallest size and using smallest positive integers > 0 which when traced will show that the sorting is not stable.
Answer:

YES. ... or ... NO. $\{?, ?\}$.

Q6. What is the big-O of the runtime in n, the size of the array?

Answer:

$O(?)$

Q7. What is the big-O of the best runtime in n, the size of the array?
Answer:

$O(?)$

Q8. What is the space complexity (i.e., memory usage) in n, the size of the array?
Answer:

$O(?)$

The next few questions below refer to our standard selectionsort.

Q9. Write down the array $\{5, 3, 1, 4, 2\}$ after two passes.
Answer:

$\{?, ?, ?, ?, ?\}$

Q10. For $\{5, 3, 1, 4, 2\}$, how many comparisons were made when the sorting ends?
Answer:

?

Q11. For $\{5, 3, 1, 4, 2\}$, how many swaps are performed when the sorting ends?
Answer:

?

Q12. Is it stable? Write YES, or write NO and then write down the simplest array of smallest size and using smallest positive integers > 0 which when traced will show that the sorting is not stable.
Answer:

YES. ... or ... NO. $\{?, ?\}$.

Q13. What is the big-O of the runtime in n, the size of the array?
Answer:

$O(?)$

Q14. What is the big-O of the best runtime in n, the size of the array?
Answer:

$O(?)$

Q15. What is the space complexity (i.e., memory usage) in n, the size of the array?
Answer:

$O(?)$

Note. For all n, it's possible that the descending array will take more wallclock time to sort than an ascending array, but asymptotically speaking, their runtimes can be the same, such as $O(n^2)$. In general, it's possible that for an algorithm for arrays, a

particular pattern will require more wallclock time to process than another pattern, but their asymptotic runtimes (in n, the size of the array) might very well be the same.

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.