

Each of the following 10 questions has the same value. If there are several parts, the credit will be divided evenly among those parts. Remember that your grade is determined by what you write on this exam paper rather than on your "actual knowledge", so write carefully and accurately, think before writing, and proofread your work when you are finished.

1. What basic input capability is provided by a Java `InputStream` object? Why is this capability too primitive and/or difficult to use for most Java programmers?

2. When is the `Serializable` interface needed for Java objects? What methods must be implemented by a class that implements this interface?

3. A Java method doing Input/Output or other tasks may encounter errors which generate exceptions. In these cases, the Java method may wish to handle the exception itself.

(a) If a Java method wants to handle an exception, how does it do this? Augment your answer with some Java code segments, if possible, to illustrate your explanation.

(b) If a Java method does not want to handle exceptions, how does it deal with them? Augment your answer with some Java code segments, if possible, to illustrate your explanation.

4. What is a "list"? What is a "stack"? What is a "queue"? In what ways are they alike? How do they differ?

5. Assume that nodes (instances of a class named `Node`) in a doubly linked list have public forward pointer fields named `next` and backward pointer fields named `previous`. Suppose also that a variable named `head` points at the first element in this list. Write lines of Java code to add a new item to the front of the list (or to add the initial item to the list, if it is empty).

6. Repeat question 5 for a singly-linked list (with forward pointers only) if new nodes are to be added at the end of the list instead of at the beginning.

10. (a) What is the time complexity of an algorithm that needs to search a linked list of size N for a particular value?

(b) Suppose an algorithm has time complexity $O(N^2)$ when solving a problem of size N . If a problem of size $N=100$ can be solved in 2 hours, how large a problem would you expect to solve in 4 hours?