2026

AP® Computer Science A

Free-Response Questions

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COMPUTER SCIENCE A
SECTION II
TIME – 1 HOUR AND 30 MINUTES

Directions:

Section II has 4 free-response questions and lasts 1 hour and 30 minutes.

All program segments must be written in Java.

Java Quick Reference information for programming questions can be used throughout the exam. A digital version is available in this application.

Assume that the classes listed in the Java Quick Reference have been imported where appropriate.

Unless otherwise noted in the question, assume that parameters in method calls are not `null` and that methods are called only when their preconditions are satisfied.

In writing solutions for each question, you may use any of the accessible methods listed in classes defined in that question. Writing significant amounts of code that can be replaced by a call to one of these methods will not receive full credit.

You may use the available paper for scratch work, but credit will only be given for responses entered in this application. Text you enter as an annotation will **not** be included as part of your answer.

You can go back and forth between questions in this section until time expires. The clock will turn red when 5 minutes remain—**the proctor will not give you any time updates or warnings.**

Note: This exam was originally administered digitally. It is presented here in a format optimized for teacher and student use in the classroom.

During the AP Exam administration, students have access to reference information. To see the reference information for this course, please visit AP Central: https://apcentral.collegeboard.org/exam-administration-ordering-scores/administering-exams/subject-specific/reference-information

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2. The `Bottle` class, which you will write, represents a bottle that contains liquid.

`Bottle` objects are created by calls to a constructor with a `double` parameter that represents the bottle's capacity, in milliliters (mL), which is the maximum amount of liquid in the bottle. Assume that this value will be greater than or equal to 0. When `Bottle` objects are constructed, each is filled to its capacity.

The `Bottle` class contains an `updateAmount` method, which updates the amount of liquid in the bottle. This method has a `double` parameter that represents the amount of liquid, in mL, to be removed from the bottle, with a precondition that the parameter is always greater than zero and less than or equal to the amount of liquid remaining in the bottle. If updating the amount of liquid in the bottle would cause it to be less than 25% of the capacity, the bottle is filled and reset to the capacity. The `updateAmount` method returns a `double` that represents the amount remaining in the bottle, in mL, after the amount has been updated.

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The following table contains a sample code execution sequence and the corresponding results. The code execution sequence appears in a class other than `Bottle`.

Statement	Return Value (blank if no value)	Explanation
`double amt;`		
`Bottle water = new Bottle(1000.0);`		A `Bottle` object named `water` is constructed with a capacity of 1,000 mL of liquid.
`amt = water.updateAmount(400.0);`	`600.0`	400 mL are used, so 600 mL remain in the bottle.
`amt = water.updateAmount(100.0);`	`500.0`	100 mL are used, so 500 mL remain in the bottle.
`amt = water.updateAmount(300.0);`	`1000.0`	300 mL are used, so 200 mL remain in the bottle. Since this amount is less than 250 mL (25% of the capacity of 1,000 mL), the bottle is immediately filled and reset to the initial amount of 1,000 mL.
`Bottle shampoo = new Bottle(40.0);`		A `Bottle` object named `shampoo` is constructed with a capacity of 40 mL of liquid.
`amt = shampoo.updateAmount(30.0);`	`10.0`	30 mL are used, so 10 mL remain in the bottle.
`amt = shampoo.updateAmount(1.0);`	`40.0`	1 mL is used, so 9 mL remain in the bottle. Since this amount is less than 10 mL (25% of the capacity of 40 mL), the bottle is immediately filled and reset to the initial amount of 40 mL.

Write the complete `Bottle` class. Your implementation must meet all specifications and conform to the examples shown in the table.

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