2020

AP CollegeBoard

Please note: Some of the questions in this former practice exam may no longer perfectly align with the AP exam. Even though these questions do not fully represent the 2020 exam, teachers indicate that imperfectly aligned questions still provide instructional value. Teachers can consult the Question Bank to determine the degree to which these questions align to the 2020 Exam.

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AP® Computer Science A
Directions for Administration

The AP Computer Science A Exam is three hours in length and consists of a multiple-choice section and a free-response section.

- The 1 hour and 30-minute multiple-choice section contains 40 questions and accounts for 50 percent of the final grade.

- The 1 hour and 30-minute free-response section contains 4 questions and accounts for 50 percent of the final grade.

A 10-minute break should be provided after Section I is completed. Students should be given a 10-minute warning prior to the end of Section II.

The actual AP Exam is administered in one session. Students will have the most realistic experience if a complete morning or afternoon is available to administer this practice exam. If a schedule does not permit one time period for the entire practice exam administration, it would be acceptable to administer Section I one day and Section II on a subsequent day.

The total score on the multiple-choice section is based only on the number of questions answered correctly. Points are not deducted for incorrect answers or unanswered questions.

- The use of calculators, or any other electronic devices, is not permitted during the exam.

- It is suggested that the practice exam be completed using a pencil to simulate an actual administration.

- Teachers will need to provide paper for the students to write their free-response answers. Teachers should provide directions to the students indicating how they wish the responses to be labeled so the teacher will be able to associate the student's response with the question the student intended to answer.

- The AP Computer Science A Exam includes a Quick Reference to the Java Library methods that may be tested on the exam. The Java Quick Reference appears at the end of each section of the exam.

- Remember that students are not allowed to remove any materials, including scratch work, from the testing site.

Name:_____

AP® Computer Science A
Student Answer Sheet
for Multiple-Choice Section

No.	Answer
1	
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No.	Answer
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COMPUTER SCIENCE A

SECTION I

Time—1 hour and 30 minutes

Number of questions—40

Percent of total grade—50

Directions: Determine the answer to each of the following questions or incomplete statements, using the available space for any necessary scratch work. Then decide which is the best of the choices given and fill in the corresponding box on the student answer sheet. No credit will be given for anything written in the examination booklet. Do not spend too much time on any one problem.

Notes:

- Assume that the classes listed in the Java Quick Reference have been imported where appropriate.
- Assume that declarations of variables and methods appear within the context of an enclosing class.
- Assume that method calls that are not prefixed with an object or class name and are not shown within a complete class definition appear within the context of an enclosing class.
- 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.

1. Consider the following method.

```
public static int mystery(int[] arr)
{
  int x = 0;

  for (int k = 0; k < arr.length; k = k + 2)
    x = x + arr[k];

  return x;
}
```

Assume that the array `nums` has been declared and initialized as follows.

```
int[] nums = {3, 6, 1, 0, 1, 4, 2};
```

What value will be returned as a result of the call `mystery(nums)` ?

(A) 5

(B) 6

(C) 7

(D) 10

(E) 17

Questions 2-3 refer to the following information.

Consider the following partial class declaration.

```
public class SomeClass
{
  private int myA;
  private int myB;
  private int myC;

  // Constructor(s) not shown

  public int getA()
  {  return myA;  }

  public void setB(int value)
  {  myB = value;  }
}
```

2. The following declaration appears in another class.

```
SomeClass obj = new SomeClass();
```

Which of the following code segments will compile without error?

(A)
```
int x = obj.getA();
```

(B)
```
int x;
obj.getA(x);
```

(C)
```
int x = obj.myA;
```

(D)
```
int x = SomeClass.getA();
```

(E)
```
int x = getA(obj);
```

---

3. Which of the following changes to `SomeClass` will allow other classes to access but not modify the value of `myC` ?

(A) Make `myC` public.

(B) Include the method:
```
public int getC()
{  return myC;  }
```

(C) Include the method:
```
private int getC()
{  return myC;  }
```

(D) Include the method:
```
public void getC(int x)
{  x = myC;  }
```

(E) Include the method:
```
private void getC(int x)
{  x = myC;  }
```

4. Consider the following code segment.

```
int x = 7;
int y = 3;

if ((x < 10) && (y < 0))
  System.out.println("Value is: " + x * y);
else
  System.out.println("Value is: " + x / y);
```

What is printed as a result of executing the code segment?

(A) `Value is: 21`

(B) `Value is: 2.3333333`

(C) `Value is: 2`

(D) `Value is: 0`

(E) `Value is: 1`

5. Consider the following method.

```
public ArrayList<Integer> mystery(int n)
{
  ArrayList<Integer> seq = new ArrayList<Integer>();

  for (int k = 1; k <= n; k++)
    seq.add(new Integer(k * k + 3));

  return seq;
}
```

Which of the following is printed as a result of executing the following statement?

```
System.out.println(mystery(6));
```

(A) `[3, 4, 7, 12, 19, 28]`

(B) `[3, 4, 7, 12, 19, 28, 39]`

(C) `[4, 7, 12, 19, 28, 39]`

(D) `[39, 28, 19, 12, 7, 4]`

(E) `[39, 28, 19, 12, 7, 4, 3]`

6. Consider the following method that is intended to determine if the `double` values `d1` and `d2` are close enough to be considered equal. For example, given a `tolerance` of `0.001`, the values `54.32271` and `54.32294` would be considered equal.

```
/** @return true if d1 and d2 are within the specified tolerance,
 *          false otherwise
 */
public boolean almostEqual(double d1, double d2, double tolerance)
{
  /* missing code */
}
```

Which of the following should replace `/* missing code */` so that `almostEqual` will work as intended?

(A) `return (d1 - d2) <= tolerance;`

(B) `return ((d1 + d2) / 2) <= tolerance;`

(C) `return (d1 - d2) >= tolerance;`

(D) `return ((d1 + d2) / 2) >= tolerance;`

(E) `return Math.abs(d1 - d2) <= tolerance;`

7. Consider the following class declaration.

```
public class Person
{
  private String myName;
  private int myYearOfBirth;

  public Person(String name, int yearOfBirth)
  {
    myName = name;
    myYearOfBirth = yearOfBirth;
  }

  public String getName()
  {  return myName;  }

  public void setName(String name)
  {  myName = name;  }

  // There may be instance variables, constructors, and methods that are not shown.
}
```

Assume that the following declaration has been made.

```
Person student = new Person("Thomas", 1995);
```

Which of the following statements is the most appropriate for changing the name of `student` from `"Thomas"` to `"Tom"` ?

(A) `student = new Person("Tom", 1995);`

(B) `student.myName = "Tom";`

(C) `student.getName("Tom");`

(D) `student.setName("Tom");`

(E) `Person.setName("Tom");`

8. Consider the following class declaration.

```
public class Student
{
  private String myName;
  private int myAge;

  public Student()
  {  /* implementation not shown */  }

  public Student(String name, int age)
  {  /* implementation not shown */  }

  // No other constructors
}
```

Which of the following declarations will compile without error?

I. `Student a = new Student();`

II. `Student b = new Student("Juan", 15);`

III. `Student c = new Student("Juan", "15");`

(A) I only

(B) II only

(C) I and II only

(D) I and III only

(E) I, II, and III

9. Consider the following method that is intended to return the sum of the elements in the array `key`.

```
public static int sumArray(int[] key)
{
  int sum = 0;

  for (int i = 1; i <= key.length; i++)
  {
    /* missing code */
  }

  return sum;
}
```

Which of the following statements should be used to replace `/* missing code */` so that `sumArray` will work as intended?

(A) `sum = key[i];`

(B) `sum += key[i - 1];`

(C) `sum += key[i];`

(D) `sum += sum + key[i - 1];`

(E) `sum += sum + key[i];`

Questions 10-11 refer to the following information.

Consider the following instance variable and methods. You may assume that `data` has been initialized with length > 0. The methods are intended to return the index of an array element equal to `target`, or -1 if no such element exists.

```
private int[] data;

public int seqSearchRec(int target)
{
  return seqSearchRecHelper(target, data.length - 1);
}


private int seqSearchRecHelper(int target, int last)
{
  // Line 1

  if (data[last] == target)
    return last;
  else
    return seqSearchRecHelper(target, last - 1);
}
```

10. For which of the following test cases will the call `seqSearchRec(5)` always result in an error?

I. `data` contains only one element.

II. `data` does not contain the value 5.

III. `data` contains the value 5 multiple times.

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I, II, and III

---

11. Which of the following should be used to replace `// Line 1` in `seqSearchRecHelper` so that `seqSearchRec` will work as intended?

(A)
```
if (last <= 0)
  return -1;
```

(B)
```
if (last < 0)
  return -1;
```

(C)
```
if (last < data.length)
  return -1;
```

(D)
```
while (last < data.length)
```

(E)
```
while (last >= 0)
```

GO ON TO THE NEXT PAGE.

12. Consider the following method.

```
public String mystery(String input)
{
  String output = "";

  for (int k = 1; k < input.length(); k = k + 2)
  {
    output += input.substring(k, k + 1);
  }

  return output;
}
```

What is returned as a result of the call `mystery("computer")` ?

(A) `"computer"`

(B) `"cmue"`

(C) `"optr"`

(D) `"ompute"`

(E) Nothing is returned because an `IndexOutOfBoundsException` is thrown.

13. Consider the following code segment.

```
int[] arr = {7, 2, 5, 3, 0, 10};
for (int k = 0; k < arr.length - 1; k++)
{
  if (arr[k] > arr[k + 1])
    System.out.print(k + "  " + arr[k] + "  ");
}
```

What will be printed as a result of executing the code segment?

(A) `0  2  2  3  3  0`

(B) `0  7  2  5  3  3`

(C) `0  7  2  5  5  10`

(D) `1  7  3  5  4  3`

(E) `7  2  5  3  3  0`

14. Consider the following interface and class declarations.

```
public interface Vehicle
{
  /** @return the mileage traveled by this Vehicle
   */
  double getMileage();
}


public class Fleet
{
  private ArrayList<Vehicle> myVehicles;

  /** @return the mileage traveled by all vehicles in this Fleet
   */
  public double getTotalMileage()
  {
    double sum = 0.0;

    for (Vehicle v : myVehicles)
    {
      sum += /* expression */ ;
    }

    return sum;
  }

  // There may be instance variables, constructors, and methods that are not shown.
}
```

Which of the following can be used to replace `/* expression */` so that `getTotalMileage` returns the total of the miles traveled for all vehicles in the fleet?

(A) `getMileage(v)`

(B) `myVehicles[v].getMileage()`

(C) `Vehicle.get(v).getMileage()`

(D) `myVehicles.get(v).getMileage()`

(E) `v.getMileage()`

15. Consider the following method, `isSorted`, which is intended to return `true` if an array of integers is sorted in nondecreasing order and to return `false` otherwise.

```
/** @param data an array of integers
 *  @return true if the values in the array appear in sorted (nondecreasing) order
 */
public static boolean isSorted(int[] data)
{
  /* missing code */
}
```

Which of the following can be used to replace `/* missing code */` so that `isSorted` will work as intended?

I.
```
for (int k = 1; k < data.length; k++)
{
  if (data[k - 1] > data[k])
    return false;
}
return true;
```

II.
```
for (int k = 0; k < data.length; k++)
{
  if (data[k] > data[k + 1])
    return false;
}
return true;
```

III.
```
for (int k = 0; k < data.length - 1; k++)
{
  if (data[k] > data[k + 1])
    return false;
  else
    return true;
}
return true;
```

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I and III only

GO ON TO THE NEXT PAGE.

16. Consider the following incomplete method that is intended to return an array that contains the contents of its first array parameter followed by the contents of its second array parameter.

```
public static int[] append(int[] a1, int[] a2)
{
  int[] result = new int[a1.length + a2.length];

  for (int j = 0; j < a1.length; j++)
    result[j] = a1[j];

  for (int k = 0; k < a2.length; k++)
    result[ /* index */ ] = a2[k];

  return result;
}
```

Which of the following expressions can be used to replace `/* index */` so that `append` will work as intended?

(A) `j`

(B) `k`

(C) `k + a1.length - 1`

(D) `k + a1.length`

(E) `k + a1.length + 1`

17. Consider the following code segment.

```
int[] arr = {1, 2, 3, 4, 5, 6, 7};

for (int k = 3; k < arr.length - 1; k++)
  arr[k] = arr[k + 1];
```

Which of the following represents the contents of `arr` as a result of executing the code segment?

(A) `{1, 2, 3, 4, 5, 6, 7}`

(B) `{1, 2, 3, 5, 6, 7}`

(C) `{1, 2, 3, 5, 6, 7, 7}`

(D) `{1, 2, 3, 5, 6, 7, 8}`

(E) `{2, 3, 4, 5, 6, 7, 7}`

18. Assume that `myList` is an `ArrayList` that has been correctly constructed and populated with objects. Which of the following expressions produces a valid random index for `myList` ?

(A) `(int)( Math.random() * myList.size() ) - 1`

(B) `(int)( Math.random() * myList.size() )`

(C) `(int)( Math.random() * myList.size() ) + 1`

(D) `(int)( Math.random() * (myList.size() + 1) )`

(E) `Math.random(myList.size())`

19. Assume that `a` and `b` have been defined and initialized as `int` values. The expression

```
!(!(a != b ) && (b > 7))
```

is equivalent to which of the following?

(A) `(a != b) || (b < 7)`

(B) `(a != b) || (b <= 7)`

(C) `(a == b) || (b <= 7)`

(D) `(a != b) && (b <= 7)`

(E) `(a == b) && (b > 7)`

20. Consider the following method.

```
public static void arrayMethod(int nums[])
{
  int j = 0;
  int k = nums.length - 1;

  while (j < k)
  {
    int x = nums[j];
    nums[j] = nums[k];
    nums[k] = x;
    j++;
    k--;
  }
}
```

Which of the following describes what the method `arrayMethod()` does to the array `nums`?

(A) The array `nums` is unchanged.

(B) The first value in `nums` is copied to every location in the array.

(C) The last value in `nums` is copied to every location in the array.

(D) The method generates an `ArrayIndexOutOfBoundsException`.

(E) The contents of the array `nums` are reversed.

21. Consider the following method, which is intended to return the element of a 2-dimensional array that is closest in value to a specified number, `val`.

```
/** @return the element of 2-dimensional array mat whose value is closest to val */
public double findClosest(double[][] mat, double val)
{
  double answer = mat[0][0];
  double minDiff = Math.abs(answer - val);
  for (double[] row : mat)
  {
    for (double num : row)
    {
      if ( /* missing code */ )
      {
        answer = num;
        minDiff = Math.abs(num - val);
      }
    }
  }
  return answer;
}
```

Which of the following could be used to replace `/* missing code */` so that `findClosest` will work as intended?

(A) `val - row[num] < minDiff`

(B) `Math.abs(num - minDiff) < minDiff`

(C) `val - num < 0.0`

(D) `Math.abs(num - val) < minDiff`

(E) `Math.abs(row[num] - val) < minDiff`

22. Consider the following `Book` and `AudioBook` classes.

```
public class Book
{
  private int numPages;
  private String bookTitle;

  public Book(int pages, String title)
  {
    numPages = pages;
    bookTitle = title;
  }

  public String toString()
  {
    return bookTitle + " " + numPages;
  }

  public int length()
  {
    return numPages;
  }
}


public class AudioBook extends Book
{
  private int numMinutes;

  public AudioBook(int minutes, int pages, String title)
  {
    super(pages, title);
    numMinutes = minutes;
  }

  public int length()
  {
    return numMinutes;
  }

  public double pagesPerMinute()
  {
    return ((double) super.length()) / numMinutes;
  }
}
```

Consider the following code segment that appears in a class other than `Book` or `AudioBook`.

```
Line 1:  Book[] books = new Book[2];
Line 2:  books[0] = new AudioBook(100, 300, "The Jungle");
Line 3:  books[1] = new Book(400, "Captains Courageous");
Line 4:  System.out.println(books[0].pagesPerMinute());
Line 5:  System.out.println(books[0].toString());
Line 6:  System.out.println(books[0].length());
Line 7:  System.out.println(books[1].toString());
```

Which of the following best explains why the code segment will not compile?

(A) Line 2 will not compile because variables of type `Book` may not refer to variables of type `AudioBook`.

(B) Line 4 will not compile because variables of type `Book` may only call methods in the `Book` class.

(C) Line 5 will not compile because the `AudioBook` class does not have a method named `toString` declared or implemented.

(D) Line 6 will not compile because the statement is ambiguous. The compiler cannot determine which `length` method should be called.

(E) Line 7 will not compile because the element at index 1 in the array named `books` may not have been initialized.

23. Consider the following instance variable and method.

```
private List<String> animals;

public void manipulate()
{
  for (int k = animals.size() - 1; k > 0; k--)
  {
    if (animals.get(k).substring(0, 1).equals("b"))
    {
      animals.add(animals.size() - k, animals.remove(k));
    }
  }
}
```

Assume that `animals` has been instantiated and initialized with the following contents.

```
["bear", "zebra", "bass", "cat", "koala", "baboon"]
```

What will the contents of `animals` be as a result of calling `manipulate` ?

(A) `["baboon", "zebra", "bass", "cat", "bear", "koala"]`

(B) `["bear", "zebra", "bass", "cat", "koala", "baboon"]`

(C) `["baboon", "bear", "zebra", "bass", "cat", "koala"]`

(D) `["bear", "baboon", "zebra", "bass", "cat", "koala"]`

(E) `["zebra", "cat", "koala", "baboon", "bass", "bear"]`

24. Consider the following code segment.

```
int[] oldArray = {1, 2, 3, 4, 5, 6, 7, 8, 9};
int[][] newArray = new int[3][3];

int row = 0;
int col = 0;
for (int value : oldArray)
{
  newArray[row][col] = value;
  row++;
  if ((row % 3) == 0)
  {
    col++;
    row = 0;
  }
}

System.out.println(newArray[0][2]);
```

What is printed as a result of executing the code segment?

(A) 3

(B) 4

(C) 5

(D) 7

(E) 8

25. A rectangular box fits inside another rectangular box if and only if the height, width, and depth of the smaller box are each less than the corresponding values of the larger box. Consider the following three interface declarations that are intended to represent information necessary for rectangular boxes.

I.
```
public interface RBox
{
  /** @return the height of this RBox */
  double getHeight();

  /** @return the width of this RBox */
  double getWidth();

  /** @return the depth of this RBox */
  double getDepth();
}
```

II.
```
public interface RBox
{
  /** @return true if the height of this RBox is less than the height of other;
   *          false otherwise
   */
  boolean smallerHeight(RBox other);

  /** @return true if the width of this RBox is less than the width of other;
   *          false otherwise
   */
  boolean smallerWidth(RBox other);

  /** @return true if the depth of this RBox is less than the depth of other;
   *          false otherwise
   */
  boolean smallerDepth(RBox other);
}
```

III.
```
public interface RBox
{
  /** @return the surface area of this RBox */
  double getSurfaceArea();

  /** @return the volume of this RBox */
  double getVolume();
}
```

Which of the interfaces, if correctly implemented by a `Box` class, would be sufficient functionality for a user of the `Box` class to determine if one `Box` can fit inside another?

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I, II, and III

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26. Assume that the array `arr` has been defined and initialized as follows.

```
int[] arr = /* initial values for the array */ ;
```

Which of the following will correctly print all of the odd integers contained in `arr` but none of the even integers contained in `arr` ?

(A)
```
for (int x : arr)
  if (x % 2 != 0)
    System.out.println(x);
```

(B)
```
for (int k = 1; k < arr.length; k++)
  if (arr[k] % 2 != 0)
    System.out.println(arr[k]);
```

(C)
```
for (int x : arr)
  if (x % 2 != 0)
    System.out.println(arr[x]);
```

(D)
```
for (int k = 0; k < arr.length; k++)
  if (arr[k] % 2 != 0)
    System.out.println(k);
```

(E)
```
for (int x : arr)
  if (arr[x] % 2 != 0)
    System.out.println(arr[x]);
```

Questions 27-28 refer to the following method.

```
public static int mystery(int n)
{
  int x = 1;
  int y = 1;

  // Point A

  while (n > 2)
  {
    x = x + y;

    // Point B

    y = x - y;
    n--;
  }

  // Point C

  return x;
}
```

27. What value is returned as a result of the call `mystery(6)` ?

(A) 1

(B) 5

(C) 6

(D) 8

(E) 13

---

28. Which of the following is true of method `mystery` ?

(A) `x` will sometimes be `1` at `// Point B`.

(B) `x` will never be `1` at `// Point C`.

(C) `n` will never be greater than `2` at `// Point A`.

(D) `n` will sometimes be greater than `2` at `// Point C`.

(E) `n` will always be greater than `2` at `// Point B`.

29. Consider the following code segment.

```
for (int k = 1; k <= 100; k++)
  if ((k % 4) == 0)
    System.out.println(k);
```

Which of the following code segments will produce the same output as the code segment above?

(A)
```
for (int k = 1; k <= 25; k++)
  System.out.println(k);
```

(B)
```
for (int k = 1; k <= 100; k = k + 4)
  System.out.println(k);
```

(C)
```
for (int k = 1; k <= 100; k++)
  System.out.println(k % 4);
```

(D)
```
for (int k = 4; k <= 25; k = 4 * k)
  System.out.println(k);
```

(E)
```
for (int k = 4; k <= 100; k = k + 4)
  System.out.println(k);
```

30. Consider the following method.

```
public static String scramble(String word, int howFar)
{
  return word.substring(howFar + 1, word.length()) +
         word.substring(0, howFar);
}
```

What value is returned as a result of the call `scramble("compiler", 3)`?

(A) `"compiler"`

(B) `"pilercom"`

(C) `"ilercom"`

(D) `"ilercomp"`

(E) No value is returned because an `IndexOutOfBoundsException` will be thrown.

GO ON TO THE NEXT PAGE.

31. Consider the following method.

```
public void mystery(int[] data)
{
  for (int k = 0; k < data.length - 1; k++)
    data[k + 1] = data[k] + data[k + 1];
}
```

The following code segment appears in another method in the same class.

```
int[] values = {5, 2, 1, 3, 8};
mystery(values);
for (int v : values)
  System.out.print(v + " ");
System.out.println();
```

What is printed as a result of executing the code segment?

(A) `5 2 1 3 8`

(B) `5 7 3 4 11`

(C) `5 7 8 11 19`

(D) `7 3 4 11 8`

(E) Nothing is printed because an `ArrayIndexOutOfBoundsException` is thrown during the execution of method `mystery`.

32. Consider the following method.

```
public int compute(int n, int k)
{
  int answer = 1;

  for (int i = 1; i <= k; i++)
    answer *= n;

  return answer;
}
```

Which of the following represents the value returned as a result of the call `compute(n, k)` ?

(A) $n*k$

(B) $n!$

(C) n^k

(D) 2^k

(E) k^n

GO ON TO THE NEXT PAGE.

33. Consider the following code segment.

```
int sum = 0;
int k = 1;
while (sum < 12 || k < 4)
  sum += k;

System.out.println(sum);
```

What is printed as a result of executing the code segment?

(A) 6

(B) 10

(C) 12

(D) 15

(E) Nothing is printed due to an infinite loop.

34. Consider the following class declarations.

```
public class Point
{
  private double x;  // x-coordinate
  private double y;  // y-coordinate

  public Point()
  {
    x = 0;
    y = 0;
  }

  public Point(double a, double b)
  {
    x = a;
    y = b;
  }

  // There may be instance variables, constructors, and methods that are not shown.
}


public class Circle
{
  private Point center;
  private double radius;

  /** Constructs a circle where (a, b) is the center and r is the radius.
   */
  public Circle(double a, double b, double r)
  {
    /* missing code */
  }
}
```

Which of the following replacements for `/* missing code */` will correctly implement the `Circle` constructor?

I.
```
center = new Point();
radius = r;
```

II.
```
center = new Point(a, b);
radius = r;
```

III.
```
center = new Point();
center.x = a;
center.y = b;
radius = r;
```

(A) I only

(B) II only

(C) III only

(D) II and III only

(E) I, II, and III

GO ON TO THE NEXT PAGE.

35. Consider the following code segment.

```
int num = 2574;
int result = 0;

while (num > 0)
{
  result = result * 10 + num % 10;
  num /= 10;
}
System.out.println(result);
```

What is printed as a result of executing the code segment?

(A) 2

(B) 4

(C) 18

(D) 2574

(E) 4752

36. Consider the following method.

```
public void test(int x)
{
  int y;

  if (x % 2 == 0)
    y = 3;
  else if (x > 9)
    y = 5;
  else
    y = 1;

  System.out.println("y = " + y);
}
```

Which of the following test data sets would test each possible output for the method?

(A) 8, 9, 12

(B) 7, 9, 11

(C) 8, 9, 11

(D) 8, 11, 13

(E) 7, 9, 10

37. Consider the following code segment.

```
int x = 1;
while ( /* missing code */ )
{
  System.out.print(x + " ");
  x = x + 2;
}
```

Consider the following possible replacements for `/* missing code */`.

I. `x < 6`

II. `x != 6`

III. `x < 7`

Which of the proposed replacements for `/* missing code */` will cause the code segment to print only the values `1 3 5` ?

(A) I only

(B) II only

(C) I and II only

(D) I and III only

(E) I, II, and III

38. Assume that `x` and `y` have been declared and initialized with `int` values. Consider the following Java expression.

```
(y > 10000) || (x > 1000 && x < 1500)
```

Which of the following is equivalent to the expression given above?

(A) `(y > 10000 || x > 1000) && (y > 10000 || x < 1500)`

(B) `(y > 10000 || x > 1000) || (y > 10000 || x < 1500)`

(C) `(y > 10000) && (x > 1000 || x < 1500)`

(D) `(y > 10000 && x > 1000) || (y > 10000 && x < 1500)`

(E) `(y > 10000 && x > 1000) && (y > 10000 && x < 1500)`

39. Consider the following recursive method.

```
public int recur(int n)
{
  if (n <= 10)
    return n * 2;
  else
    return recur(recur(n / 3));
}
```

What value is returned as a result of the call `recur(27)` ?

(A) 8

(B) 9

(C) 12

(D) 16

(E) 18

40. Consider the following recursive method.

```
public static void whatsItDo(String str)
{
  int len = str.length();
  if (len > 1)
  {
    String temp = str.substring(0, len - 1);
    whatsItDo(temp);
    System.out.println(temp);
  }
}
```

What is printed as a result of the call `whatsItDo("WATCH")` ?

(A)
```
WATC
WAT
WA
W
```

(B)
```
WATCH
WATC
WAT
WA
```

(C)
```
W
WA
WAT
WATC
```

(D)
```
W
WA
WAT
WATC
WATCH
```

(E)
```
WATCH
WATC
WAT
WA
W
WA
WAT
WATC
WATCH
```

END OF SECTION I

IF YOU FINISH BEFORE TIME IS CALLED,
YOU MAY CHECK YOUR WORK ON THIS SECTION.

DO NOT GO ON TO SECTION II UNTIL YOU ARE TOLD TO DO SO.

Java Quick Reference

Accessible Methods from the Java Library That May Be Included on the Exam

class java.lang.Object

- `boolean equals(Object other)`
- `String toString()`

class java.lang.Integer

- `Integer(int value)`
- `int intValue()`
- `Integer.MIN_VALUE` // minimum value represented by an `int` or `Integer`
- `Integer.MAX_VALUE` // maximum value represented by an `int` or `Integer`

class java.lang.Double

- `Double(double value)`
- `double doubleValue()`

class java.lang.String

- `int length()`
- `String substring(int from, int to)` // returns the substring beginning at `from`
  // and ending at `to-1`
- `String substring(int from)` // returns `substring(from, length())`
- `int indexOf(String str)` // returns the index of the first occurrence of `str`;
  // returns `-1` if not found
- `int compareTo(String other)` // returns a value < 0 if `this` is less than `other`
  // returns a value = 0 if `this` is equal to `other`
  // returns a value > 0 if `this` is greater than `other`

class java.lang.Math

- `static int abs(int x)`
- `static double abs(double x)`
- `static double pow(double base, double exponent)`
- `static double sqrt(double x)`
- `static double random()` // returns a `double` in the range [0.0, 1.0)

interface java.util.List<E>

- `int size()`
- `boolean add(E obj)` // appends `obj` to end of list; returns `true`
- `void add(int index, E obj)` // inserts `obj` at position `index` (0 ≤ `index` ≤ size),
  // moving elements at position `index` and higher
  // to the right (adds 1 to their indices) and adjusts size
- `E get(int index)`
- `E set(int index, E obj)` // replaces the element at position `index` with `obj`
  // returns the element formerly at the specified position
- `E remove(int index)` // removes element from position `index`, moving elements
  // at position `index + 1` and higher to the left
  // (subtracts 1 from their indices) and adjusts size
  // returns the element formerly at the specified position

class java.util.ArrayList<E> implements java.util.List<E>