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AP Computer Science Midterm Review

Things to know:

- When a variable's data type can change
- What year hard disks typically store tens of billions of information
- What is the cheapest way to improve a computer's performance
- How many bytes it takes to represent each character in the ASCII character encoding scheme
- The form to send messages to objects
- Where Java programs can be written
- The syntax for manipulating primitive data types compared to the syntax for manipulating objects
- What literals are restricted to
- How to write the names of constants
- What the Random class must first import
- What the for loop allows the programmer to declare
- What rules class names must adhere to
- What is a program
- What are strings
- What is vocabulary
- Know the order of operations for evaluating an expression
- What are logic errors
- What is overloading
- What are Boolean expressions
- What is the for statement
- What is a superclass parent.

Chapter 1:

1. What are the three major hardware components of a computer?

① The memory
② the central processing unit (CPU)
③ input/output devices

2. Name three input devices.

① Keyboard ④ modem
② mouse ⑤ disk
③ microphone

3. Name two output devices.

① monitor
② speakers
③ printer
④ disk

4. What is the difference between application software and system software?

Application software - is used to solve specialized problems for users such as maintaining a payroll account.

System software manages the resources of the computer, such as files on a disk.

5. Name a first-generation programming language, a second-generation programming language, and a third-generation programming language.

First generation - machine language

Second generation - assembly language

Third generation - high-level languages (FORTRAN, COBOL, PASCAL, C)

6. Name the six phases of the waterfall model.

- ① Customer request
- ② Analysis
- ③ Design
- ④ Implementation
- ⑤ Integration
- ⑥ Maintenance

7. When did personal computers (PCs) first begin to appear and become popular?

1980's

8. What type of programming language is Java and example of?

High-level language.

9. What do you use to convert a program written in a high-level language such as C or PASCAL into machine language form?

use a program called a compiler

10. Translate 10110111_2 to a base 10 number.

$$\begin{aligned} &= (1 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) \\ &= 128 + 0 + 32 + 16 + 0 + 4 + 2 + 1 \\ &= \boxed{183} \end{aligned}$$

11. Translate $16B8_{16}$ to a base 10 number.

$$\begin{aligned} &(1 \times 16^3) + (6 \times 16^2) + (11 \times 16^1) + (8 \times 16^0) \\ &4,096 + 1536 + 176 + 8 \\ &\quad \boxed{5816} \end{aligned}$$

12. What does ACM stand for?

Association for Computing Machinery

13. What phase of the waterfall cycle incurs the highest cost for developers and which phase incurs the least expenses for the developers.

highest = The maintenance phase
lowest = Analysis phase

14. What are the two differences between assembly language and high-level language.

- high-level languages are portable and use compilers to translate to machine language.
- Easy to write, read, and understand compared to assembly language.

15. How many individual characters is the ASCII character encoding scheme able to encode?

256 possibilities

ASCII uses 8 bits or a byte.

Chapter 2:

1. List three reasons why Java is an important programming language.

Safe

Robust

Portable

2. What is byte code?

is code produced by the Java compiler.
Byte code is machine independent and is executed by a Java interpreter.

3. What is the JVM?

Java Virtual Machine is a program that runs a Java program.

4. List two objects that are used for terminal input and output in Java programs.

Terminal I/O objects include a Scanner and System.out

5. Give examples of two compile-time errors.

- ① omission of a semicolon at the end of a statement.
- ② omission of a double quote at the end of a string.

6. What steps must be followed to run a Java program?

After a program is edited and compiled, it can be run by using the java command with the byte code's file name at the command line prompt.

7. What is the purpose of an import statement in a Java program?

An import statement directs the compiler to use code from a Java library or package or a user-defined library or package.

8. What makes a Java program easy to transport to another type of computer? How is that done?

Java is easy to transport because of JVM (Java Virtual Machine).
When a Java source code is created it is initially compiled into byte code.
The byte code is interpreted as the program is executed by the JVM.

Any computer with JVM on it can translate the byte code file and execute it on that machine.

9. What makes Java a more secure language than any other language? Is it possible to violate Java's security features?

Considered more secure because of the Java Virtual Machine.

Java programs all execute inside the JVM, which means they cannot perform any activities not supported by the JVM. This limits the ability of a Java program to cause harm to the computer it is running on.

- yes it is possible to find ways around Java's security measures.

10. Describe the difference between a graphical user interface (GUI) and a terminal I/O interface.

GUI - commonly used in most Windows and Macintosh software applications. user is presented windows, dialog boxes, command and option buttons, and icons that can be manipulated to perform desired tasks.

Terminal I/O - used on DOS and MS-DOS PC. User is presented with a prompt on the display screen. Must enter a system command or a response to a question asked by the system. - called line-io

11. Write a sequence of statement to display your name, address, and phone number in the terminal window.

```
System.out.println("Enter name");  
System.out.println("Enter Street name");  
System.out.println("Enter City, State, Zip Code");  
System.out.println("Enter phone number");
```

Chapter 3:

1. Give examples of an integer literal, a floating-point literal, and a string literal.

integer literal - 56

Floating-point literal - 3.14

String literal - "Hello there!"

2. Declare variables to represent a person's name, age, and hourly wage.

String name;

int age;

double wage;

3. Why must care be taken to order the operators in an arithmetic expression?

Some operators, such as *, have a higher precedence than others, such as + or -. They are not simply evaluated in left-to-right order.

4. State which of the following are valid Java identifiers. For those that are not valid, explain why.

a) length

Valid

b) import

Invalid - import is a reserved word

c) 6months

Invalid - identifiers cannot begin with a digit

d) Hello-and-goodbye

Invalid - identifiers cannot contain hyphens

e) HERE_AND_THERE

Valid

Chapter 4:

- Java has some useful operators for extended assignment, such as += and for increment and decrement.
- The Math class provides several useful methods, such as sqrt and abs.
- The Random class allows you to generate random integers and floating-point numbers.
- In order for a program to use the Random class it must first import java.util.Random.
- if and if-else statements are used to make one-way and two-way decisions.
- It is better to overuse braces than to under use them.
- Braces always occur in pairs and no semicolon immediately follows a closing brace.
- Braces can be dropped if only a single statement follows the word if or else.
- Relational operators are only used to test whether two values are equal, greater than, less than, and etc.
- If-else statements are commonly used to check user inputs before processing them.
- The comparison operators, such as ==, <=, and >=, return Boolean values that serve as conditions of control statements.
- The while loop allows the program to run a set of statements repeatedly until condition becomes false.
- The for loop is more concise version of the while loop.
- In a for loop the counter is updated after the test yields true and the statements in the loop body are executed.
- The for loop allows the programmer to declare the loop control variable inside of the loop header.
- The choice between a while loop and a for loop is often a matter of programmer style or taste.
- Other control statements, such as an if statement, can be nested within loops. A break statement can be used in conjunction with an if statement to terminate a loop early.
- A loop, either for or while, terminates immediately when a break statement is executed.
- **A sentinel-controlled loop can be used to read all of the data from a file.**
- Failure to close the output file may result in no data being saved to it.
- File objects are instances of the class File, which appears in the package java.io.
- I/O exceptions are generally so serious that they belong to a category called *checked expressions*
- Data can be output to a text file using the class PrintWriter.
- There are many kinds of logic errors that can occur in loops. Examples are the off-by-one error and the infinite loop.

Practice Problems

1. Translate the following statements to equivalent statements that use extended assignment operators.
 - a) $x = x * 3$ $x *= 3$
 - b) $x = x / 2$ $x /= 2$
 - c) $y = y - 4$ $y -= 4$
2. Assume that x is 5 and y is 10. Write the values of the following expressions:
 - a) $x * 2 < y$ *False*
 - b) $y + 3 == 13$ *True*
 - c) $x < y < 15$ *invalid, syntactically incorrect*
3. What output will be displayed to the console if a user enters the number 16 when prompted for the following code fragment?

```
System.out.print ("Enter a positive integer: ");
```

```
int n = reader.nextInt();
```

```
int limit = n / 2;
```

```
for (int d=2; d <= limit; d++){
    if (n % d == 0)
        System.out.print(d + " ");
}
```

2, 4, 8

$n = 16$

ent. 16

int. limit = $\frac{16}{2} = 8$

d	d <= limit	n % d == 0	d++
2	T	T	3
3	T	F	4
4	T	T	5
5	T	F	6
6	T	F	7
7	T	F	8
8	T	T	9
9	F		

4. Assume that the variables x and y contain the values 19 and 2, respectively, Indicate if the Boolean expressions below are true, false, or syntactically incorrect.

a) $x \leq y$ False

b) $x * 2 > y$ True

c) $x - 1 == y * 9$ True

d) $x < y < 25$ Invalid, syntactically incorrect

e) $x * 2 != y$ True

5. Write code segments that use for loops to perform the following tasks:

- a) Print the squares and cubes of the first 8 positive integers.

```
int limit = 8, count = 1;
for (count = 1; count <= limit; count++) {
    if (count > 0) {
        System.out.println(count * count);
        System.out.println(Math.pow(count, 3));
    }
}
```

- b) Build a string consisting of the first 8 positive digits in descending order.

```
int limit = 8, count = 1;
for (count = limit; count >= 1; count--) {
    if (count <= limit)
        S = S + count;
}
```

Chapter 5:

- Java class definitions consist of instance variables, constructors, and methods.
 - Constructors initialize an object's instance variables when the object is created. A default constructor expects no parameters and sets the variables to reasonable default values. Other constructors expect parameters that allow clients to set up objects with specified data.
 - Mutator methods modify an object's instance variables, whereas accessor methods merely allow clients to observe the values of these variables
 - The visibility modifier `public` is used to make methods visible to clients, whereas the visibility modifier `private` is used to encapsulate or restrict access to variables and methods.
 - Helper methods are methods that are called from other methods in a class definition. They are usually declared to be `private`.
 - Variables within a class definition can be instance variables, local variables, or parameters. Instance variables are used to track the state of an object. Local variables are used for temporary working storage within a method. Parameters are used to transmit data to a method.
 - A formal parameter appears in a method's signature and is referenced in its code. An actual parameter is a value passed to a method when it is called. A method's actual parameters must match its formal parameters in number, position, and type.
 - The scope of a variable is the area of the program text within which it is visible. The scope of an instance variable is the entire class within which it is declared. The scope of a local variable or a parameter is the body of the method within which it is declared.
 - The lifetime of a variable is the period of program execution during which its storage can be accessed. The lifetime of an instance variable is the same as the lifetime of a particular object. The lifetime of a local variable and a parameter is the time during which a particular call of a method is active.
 - A client needs to know only a server's interface.
 - It is possible for two variables to refer to the same object.
 - A reference variable can be compared to the null value.
 - Class names must adhere to the rules for naming variables and methods.
 - If a class template contains no constructors, the JVM provides a primitive default constructor.
 - If the return type of a method is not void, it can be any primitive or reference type.
 - Method names have the same syntax as other Java identifiers.
 - When an object is instantiated, it gets a complete set of fresh instance variables.
 - Know when you can use local and global variables.
 - Assessors – methods that are used to access an object's state
 - Default constructors- constructors with an empty parameter list
 - Arguments – values passed to a method when it is invoked.
 - An object has behavior as defined by the methods of its class.
 - Information hiding- a server's data requirements and the implementation of its methods are hidden from the client.
 - Constructors are methods used to initialize a new object.
 - At the base of Java's class hierarchy is called an object.
 - Constructors are activated when they keyword `new` is used.
1. What is the general form of a method?

1. For each expression in the left-hand column, indicate its value in the right-hand column. Be sure to list a constant of appropriate type and capitalization.
e.g., 7 for an int, 7.0 for a double, "hello" for a String, true or false for a boolean.

Expression

Value

5 * (5 + 1) - 2 - 4 + 1

25

9 % 5 + 20 % 5 + 20 % 3

6

5.3 * 4.0 + 1.7 * 13 / 3

28.57

1 + 2 + "3 + 4" + 5 + 6 / 4

33 + 451

7 % 2 + 12 / 6 / 6 + 4.2

6.2

2. For each call below to the following method, write the output that is produced, as it would appear on the console:

```
public static void ifElseMystery(int x, int y){
    int z = 4;
    if (z <= x) {
        z = x + 1;
    } else {
        z = z + 9;
    }
    If (z <= y) {
        y++;
    }
    System.out.println (z + " " + y);
}
```

Method Call

Output

ifElseMystery(3, 20);

13 21

ifElseMystery(5, 4);

6 5

ifElseMystery(7, 6);

8 7

ifElseMystery(4, 12);

5 13

ifElseMystery(8, 2);

9

3. For each call below to the following method, write the output that is produced, as it would appear on the console:

```
public static void whileMystery(int n) {  
    int x = 0;  
    int y = 1;  
    while(n > x && n > y) {  
        n--;  
        x = x + 2;  
        y = y + x;  
    }  
    System.out.println(x);  
}
```

Method Call

Output

whileMystery(4);

2

whileMystery(12);

6

whileMystery(6);

4

whileMystery(17);

8

whileMystery(2);

2

4. What output is produced by the following program?

```
public class ParameterMystery {  
    public static void main (String[] args) {  
        String head = "shoulders";  
        String knees = "toes";  
        String elbow = "head";  
        String eye = "eyes and ears";  
        String ear = "eye";  
  
        touch(ear, knees);  
        touch(elbow, head);  
        touch(head, "eye");  
        touch(knees, knees);  
        touch(eye, "Toes");  
        touch(elbow, "knees" + ear);  
    }  
}
```

```
Public static void touch (String elbow, String ear) {  
    System.out.println("touch your" + elbow + " to your " + ear);  
}
```

touch your eye to your toes
touch your head to your shoulders
touch your shoulders to your eye
touch your toes to your toes
touch your eyes and ears to your toes
touch your head to your knees eyes and ears.