Exam 1

● Graded

Student

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Total Points

105 / 130 pts

Question 1

Data Types **8** / 8 pts

1.1 **Data Types** **2** / 2 pts

✔ **+ 2 pts** Correct

+ 0 pts Incorrect

1.2 **(no title)** **2** / 2 pts

✔ **+ 2 pts** Correct

+ 0 pts Incorrect

1.3 **(no title)** **2** / 2 pts

✔ **+ 2 pts** Correct

+ 0 pts Incorrect

1.4 **(no title)** **2** / 2 pts

✔ **+ 2 pts** Correct

+ 0 pts Incorrect

Question 2

Data Types Short Answer **22** / 22 pts

2.1 **Data Types** **12** / 12 pts

✔ **+ 12 pts**

Expression	Type	Value
`(8 / 3) + 2.0`	double	4.0
`492 / 10 % 10 / 2`	int	4
`53 / 5 / (0.6 + 1.4) / 2 + 13 / 2`	double	8.5
`"Computer 32" + 2 * 3`	String	Computer 326
`"(int)2.0" + 2 * 5`	String	(int)2.010
`4 + (-3 + 2) > -3 - (-3 + 4) * 2`	boolean	true

+ 0 pts Incorrect

+ 2 pts 1 - double, 4.0

+ 2 pts 2 - integer, 4

+ 2 pts 3 - double, 8.5

+ 2 pts 4 - String, Computer 326

+ 2 pts 5- String, (int)2.010

+ 2 pts 6- boolean, true

2.2 **(no title)** **2** / 2 pts

✔ **+ 2 pts** correct

```
String year;
int numCourses;
double gpa;
```

+ 0 pts incorrect

+ 1.5 pts For correct data types (0.5 each)

+ 0.5 pts Variable names AND colon (all of none)

2.3 **(no title)** **8** / 8 pts

✔ **+ 8 pts** Correct - 1 point for each line

x	y	z	(!x && y) && !(y || z) || (x && !z)
true	true	true	false
true	true	false	true
true	false	true	false
true	false	false	true
false	true	true	false
false	true	false	false
false	false	true	false
false	false	false	false

+ 0 pts incorrect

Question 3

Given a problem write an algorithm using Pseudocode (no loops) **10** / 35 pts

3.1 **(no title)** **10** / 10 pts

✔ **+ 10 pts** correct

+ 1 pt READ number

+ 3 pts COMPUTE firstDigit as number/100

+ 3 pts COMPUTE thirdDigit as number % 10

+ 3 pts IF(firstDigit == thirdDigit) THEN DISPLAY "Palindrome" ELSE
DISPLAY "not Palindrome" ENDIF

+ 0 pts incorrect

3.2 **(no title)** **0** / 25 pts

+ 25 pts Correct

+ 3 pts READ grossIncome
READ dividendIncome
READ savingsInterest
READ mortageInterest
READ numDependents
READ charitableDonations (0.5 for each input)

+ 3 pts SET totalTaxes to 0
COMPUTE totalIncome AS grossIncome + savingsInterest

+ 3 pts IF mortageInterest > 10,000
SET mortgageInterest TO 10,000 ENDIF

+ 3 pts IF charitableDonations > .10*grossIncome*
*SET charitableDonations TO 0.10*grossIncome ENDIF

+ 3 pts COMPUTE deductibleAmount AS numDependents*6000 + charitableDonations + mortageInterest

+ 3 pts SET taxableIncome AS taxableIncome – 50,000 ENDIF

+ 3 pts COMPUTE totalTaxes as totalTaxes + (taxableIncome)*0.08*
*COMPUTE totalTaxes AS totalTaxes + dividendIncome*0.08

+ 1 pt DISPLAY totalTaxes

+ 1 pt 1 point for trying

✔ **+ 0 pts** incorrect

+ 6 pts COMPUTE taxableIncome AS totalIncome – deductibleAmount
IF taxableIncome > 150000
COMPUTE totalTaxes as totalTaxes + (taxableIncome -150,000)*0.33*
SET taxableIncome AS taxableIncome – 150,000
ENDIF
IF taxableIncome > 50000
*COMPUTE totalTaxes as totalTaxes + (taxableIncome -50,000)*0.20

Question 4

Given a pseudocode algorithm, count the number of operations. **35** / 35 pts

4.1 **(no title)** **10** / 10 pts

✔ **+ 10 pts** Correct
minimum - 15, maximum- 21

+ 0 pts incorrect

+ 5 pts minimum 15

+ 5 pts maximum 21

4.2 **(no title)** **10** / 10 pts

✔ **+ 10 pts** Correct
3n+4

$$2 + 3x + 1 + 1 = 3n + 4$$

2 (READ, SET)

3x (3 operations in the loop, when number > 0 is true)

1 (when number>0 is false)

1 (DISPLAY)

+ 5 pts 2n+3

+ 6 pts 2n+4

+ 8 pts 3n + 3

+ 6 pts 3n+(5 or any number until 8)

+ 0 pts Incorrect

4.3 (no title) **15** / 15 pts

✔ **+ 15 pts** Correct

minimum = 6 operations

6n+4

3 + 6n + 1 + 1
3 (READ, READ, SET) +
6n (6 operations in the loop, when counter <=n is true)
1 (when counter <=n is false)
1 DISPLAY

+ 5 pts minimum = 6 operations

+ 5 pts 6n

+ 7 pts 6n+3

+ 0 pts incorrect

Question 5

(no title) **30** / 30 pts

5.1 **(no title)** **15** / 15 pts

+ 0 pts Incorrect

✔ **+ 15 pts** Correct

```
public class MyFact
{
    public static void main(String[] args)
    {
        int n = Integer.parseInt(args[0]);
        int fact = 1;
        int count = n;

        while ( count > 0)
        {
            fact = fact * count;
            count -= 1;
        }
        System.out.println(fact);
    }
}
```

5.2 **(no title)** **15** / 15 pts

✔ **+ 15 pts** Correct

The problem is scope, the program above tries to print the loop variable outside of the loop.

```
public class EvenLoop
{
    public static void main(String[] args)
    {
        int n = Integer.parseInt(args[0]);
        int x = 2;
        int z = 0;  // var to take out loop var

        for (int i = 0; i <= n*x; i+=x)
        {
            System.out.println("***" + i);
            z = i;  // set outside (global) var to i
        }

        System.out.println(x + " " + z);  // print global, not i
    }
}
```

+ 10 pts 10 pts if the student references scope (bad var, can't see, not inside loop, etc) but does not fix

+ 12 pts 12 pts if the student actually write the word "scope."

+ 14 pts 14 pts if the student fixes by using n*x instead of i in println

+ 15 pts 15 pts if they set a global var and use it outside loop.

+ 0 pts incorrect

Q1 Data Types
8 Points

Q1.1 Data Types
2 Points

Which of the following choices is the correct syntax for declaring a real number variable named 'points' and initializing its value to 10.0?

- ○ points = 10;
- ◉ double points = 10.0;
- ○ points = double 10.0;
- ○ int points : 10.0;
- ○ 10.0 = points;

Q1.2
2 Points

Which, if any, of the following is NOT a primitive type in Java?

- ○ int
- ○ double
- ◉ String
- ○ char
- ○ All of the above are Java primitive types.

Q1.3
2 Points

Assume that A and B are Boolean variables and have been properly initialized. Consider the Boolean expression: ! (!A && !B)

Which of the following always evaluates to the same value as the expression above?

- ○ (!A && !B)
- ○ (!A || !B)
- ◉ (A || B)
- ○ ! (A || B)
- ○ (!A || B)

Q1.4
2 Points

Assume that x and y are Boolean variables and have been properly initialized. Consider the Boolean expression: (x || y) && x

Which of the following always evaluates to the same value as the expression above?

- ◉ x
- ○ y
- ○ x && y
- ○ x || y
- ○ x != y

Q2 Data Types Short Answer
22 Points

Q2.1 Data Types
12 Points

Evaluate the following expressions. Give the type and value of each (2 points each = 12 points).

line	Expression	Type	Value
1	`(8 / 3) + 2.0`		
2	`492 / 10 % 10 / 2`		
3	`53 / 5 / (0.6 + 1.4) / 2 + 13 / 2`		
4	`"Computer 32" + 2 * 3`		
5	`"(int)2.0" + 2 * 5`		
6	`4 + (-3 + 2) > -3 - (-3 + 4) * 2`		

Upload a file with the corresponding table and answers, or type in your corresponding answers in the format

1 - type, value
2 - type, value

No files uploaded

1 - double, 4.0
2 - int, 4
3 - double, 8.5
4 - string, Computer 326
5 - string, (int)2.010
6 - boolean, true

Q2.2
2 Points

(2 points) Imagine you are writing a Java program that stores a student's year (Freshman, Sophomore, Junior, or Senior), the number of courses the student is taking, and his or her GPA on a 5.0 scale. Declare variables with the appropriate names and types to hold this information. Write complete variable declaration statements with the type, the variable name, and a semicolon.

```
String year;
int numCourses;
double gpa;
```

Q2.3
8 Points

Truth Table (8 Points): Complete the truth table for the Boolean Expression:

line	x	y	z	(!x && y) && !(y || z) || (x && !z)
1	true	true	true	
2	true	true	false	
3	true	false	true	
4	true	false	false	
5	false	true	true	
6	false	true	false	
7	false	false	true	
8	false	false	false	

Upload a file with the corresponding table and answers, or type in your corresponding answers in the format

1- answer
2- answer

Q3 Given a problem write an algorithm using Pseudocode (no loops)
35 Points

Q3.1
10 Points

(10 points) Write a program in pseudocode that reads a 3-digit number and determines if the number is a palindrome or not. A number is a palindrome if it reads the same from left to right and right to left. For example, 121, 212 are palindromes, but 122 is not. You may use the operators / and % to complete this assignment. You are not allowed to use loops. The program must display the messages “Palindrome” or “not Palindrome”.

```
READ num
SET x TO num
SET sum TO 0
SET a TO 0
SET b TO 0
COMPUTE a TO num % 10
COMPUTE sum TO sum*10+a
COMPUTE x/10
COMPUTE a TO num % 10
COMPUTE sum TO sum*10+a
COMPUTE x/10
COMPUTE a TO num % 10
COMPUTE sum TO sum*10+a
COMPUTE b TO x/10
IF num = x THEN
DISPLAY Palindrome
ELSE
DISPLAY not Palindrome
```

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Q3.2
25 Points

(25 points) Tax Rate. The amount of tax paid by a family will be determined based on several factors, including gross income earned by family (A), dividend income from investments (B), savings interest earned(C), home mortgage interest(D), number of dependents supported (E), and amount of charitable donations(F). In a hypothetical situation, we assume the following.

i. gross income, dividend, and savings interest are taxable
ii. the family is allowed to deduct $6000 per dependent from total income
iii. home mortgage interest is tax-deductible up to $10,000 (that is, any interest paid over $10,000 cannot be deducted)
iv. charitable donations up to 10% of gross income are tax-deductible.
v. dividend income from investments (B) is taxable at a fixed rate of 8%
vi. adjusted income is computed by subtracting deductions (D, E) from gross income + savings interest (A+C)

NOTES: The total taxes on adjusted income (adjusted income * tax Rate) are computed according to the following rules.
1. The first $50,000 of the adjusted income is computed at a tax rate of 8%
2. The next $100,000 of the adjusted income is computed at a tax rate of 20%
3. Excess adjusted income over $150,000 is computed at a tax rate of 33%

Example 1. if a family has an adjusted income of $175,000, then their tax is calculated as = 50,000*0.08 + 100,000*0.20 + (175,000-150,000)*0.33 + dividend tax
Example 2. a family with adjusted income of $82,000 will pay = 50000*0.08 + (82000-50000)*0.20 in taxes + dividend tax.
Example 3. a family with adjusted income of $42,000 will pay = 42,000*0.08 in taxes + dividend tax. **

The taxes for dividends must be calculated separately and added to the tax total. Write a program in pseudocode to compute the total taxes for a family.

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Q4 Given a pseudocode algorithm, count the number of operations.

35 Points

Q4.1
10 Points

(10 points) The following pseudocode algorithm is used daily by a delivery company to check their cardboard boxes stock. The program finds the current stock of small, medium, and large boxes. Then, if the stock of each box size is below the given limit a new order is suggested.

```
READ smallBoxStock
READ mediumBoxStock
READ largeBoxStock
READ limit
SET numberOfSmallBoxes  TO 0
SET numberOfMediumBoxes TO 0
SET numberOfLargeBoxes  TO 0
SET totalOrder TO 0

IF smallBoxStock < limit THEN
        SET numberOfSmallBoxes TO 50000
        COMPUTE totalOrder TO totalOrder +
numberOfSmallBoxes
ENDIF

IF mediumBoxStock < limit THEN
        SET numberOfMediumBoxes TO 50000
        COMPUTE totalOrder TO totalOrder +
numberOfMediumBoxes
ENDIF

IF largeBoxStock < limit THEN
        SET numberOfLargeBoxes TO 50000
        COMPUTE totalOrder TO totalOrder +
numberOfLargeBoxes
ENDIF

DISPLAY numberOfSmallBoxes
DISPLAY numberOfMediumBoxes
DISPLAY numberOfLargeBoxes
DISPLAY totalOrder
```

(5 points) What is the minimum number of operations the code executes?

15

(5 points) What is the maximum number of operations the code executes?

21

Q4.2
10 Points

(10 points) The following pseudocode counts the number of digits in a number.

```
READ number
SET counter TO 0
WHILE number > 0
      ADD 1 TO counter
      COMPUTE number AS number / 10
ENDWHILE
DISPLAY counter
```

Let x be the number of digits in a number. What is the number of operations the code executes in terms of n? In other words, craft a general formula, in terms of n, that gives you the number of operations the pseudocode executes. This formula should work for all possible x values/number sizes (0,1,2,3...).

3n+4

Q4.3
15 Points

(15 points) A lottery game works as follows: a customer selects a number n and is sold a ticket that has n numbers on it. The customer wins If all of the numbers on the ticket are the same.

For example, if n = 3, a winning ticket would be 7 7 7.

The following pseudocode simulates this game, it reads a number n and then the n numbers on the ticket, one at a time. Assume that n is at least 2.

```
READ n
READ number
SET counter TO 1
WHILE counter <= n
        READ nextNumber
        IF number != nextNumber THEN
        DISPLAY Loosing ticket
        HALT
        ELSE
        ADD 1 TO counter
        SET number TO nextNumber
        READ nextNumber
        ENDIF
ENDWHILE

DISPLAY Winning ticket
```

(5 points) What is the minimum number of operations the code executes (enter an integer number only)?

7

(10 points) What is the maximum number of operations the code executes?

6n+4

Q5
30 Points

Q5.1
15 Points

(15 points) The pseudocode below takes an integer as input and prints the factorial of that number. Write the equivalent program, including taking the integer from the command line, in Java. Call the program MyFact.java

```
READ n
SET count TO n
SET fact TO 1
WHILE count > 0
      COMPUTE fact AS fact * count
      SUBRACT 1 FROM count
ENDWHILE
DISPLAY fact
```

```
public class MyFact {
   public static void main (String [] args) {
      int n = Integer.parseInt(args [0]);
      int count = n;
      int fact = 1;

      while (count > 0){
         fact = fact*count;
         count--
      }
      System.out.println(fact);
   }
}
```

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Q5.2
15 Points

(15 points) The following program contains a bug. Find it and explain what is going wrong. Then explain how you could fix it.

For example, suppose n = 4, the output of EvenLoop is supposed to be:

```
***0
***2
***4
***6
***8
2 8
```

```
public class EvenLoop
{
    public static void main(String[] args)
    {
        int n = Integer.parseInt(args[0]);
        int x = 2;

        for (int i = 0; i <= n*x; i+=x)
        {
            System.out.println("***" + i);
        }

        System.out.println(x + " " + i);
    }
}
```

The variable i must be replaced with the variable n in the second print statement.

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