

ComS 207: Programming I
Midterm 1, Tue. Sep 19, 2006

Student Name:

Student ID Number:

Recitation Section:

1. True/False Questions (10 x 1p each = 10p)

- (a) ComS 207 Rocks! TRUE / FALSE

- (b) This is a valid identifier in Java: `_T_R-U_E_` TRUE / FALSE

- (c) This is a valid identifier in Java: `_F_A_L_$_E_` TRUE / FALSE

- (d) A class can have more than one but less than 10 constructors. TRUE / FALSE

- (e) In Java primitive type variables don't have to be defined before they can be used. TRUE / FALSE

- (f) A garbage collector must be declared for each class. TRUE / FALSE

- (g) A Java class can be named 'object'. TRUE / FALSE

- (h) `System.out` is not a reserved word in Java. TRUE / FALSE

- (i) Both an `int` and a `byte` can be used to store the number 15. TRUE / FALSE

- (j) No more than one class can be instantiated from each object. TRUE / FALSE

2. Short Answer Questions (5 x 2p each = 10p)

(a) What is a method?

(b) What is an encapsulation?

(c) What is the difference between a 'byte' and a 'Byte'?

(d) What is the difference between compile-time and run-time errors?

(e) What is the input of a Java compiler? What is the output?

3. Arithmetic Expressions (5 x 3p each = 15p)

Rewrite the following arithmetic expressions using snippets of Java code. You can assume that the named variables have already been defined to be of type double.

(a) $z = x^2 + y^3$

(b) $z = \frac{1}{1 + \frac{1}{c}}$

(c) $z = \frac{5}{4(d + 50)}$

(d) $z = \sqrt{1 - \cos^2(q)}$

(e) $z = |x^3 - 5x^2 + x - 3|$

4. What is the Output? (10p)

What is the output of the following Java program?

```
public class Problem4
{
    public static int mystery(int a, int b)
    {
        int m=(a+b)/2;
        return m;
    }

    public static void main(String[] args)
    {
        int a = 1;
        int b = 5;
        int m = 6;

        m = mystery(a,b);
        System.out.println(m);

        b = mystery(a,m-1);
        System.out.println(b);

        a = mystery(m+1, b);
        System.out.println(a);
    }
}
```

5. Expressions and Assignments (10 x 2p each = 20p)

For each of the following, write down the value that will be stored in result

```
double result;  
int num1 = 4, num2 = 11, num3 = 3;  
double val1 = 3.0, val2 = 10.0, val3 = 2.0;
```

- (a) `result = num2 / num1;`
- (b) `result = val3 + num2 / num1;`
- (c) `result = num3 + val2 / num1;`
- (d) `result = num2 / num3 / num1;`
- (e) `result = val2 * num1 + num2 / num3;`
- (f) `result = (int) (val2 * (num1 + num2) / num3);`
- (g) `result = (val2 * (num1 + num2)) / num3;`
- (h) `result = val2 * ((num1 + num2) / num3);`
- (i) `result = num1 * num3 * 4 % num2 / val3;`
- (j) `result = ++num2+- num1-+ num3++;`

6. Programming Projects (TOTAL 65p, but each has a different weight)

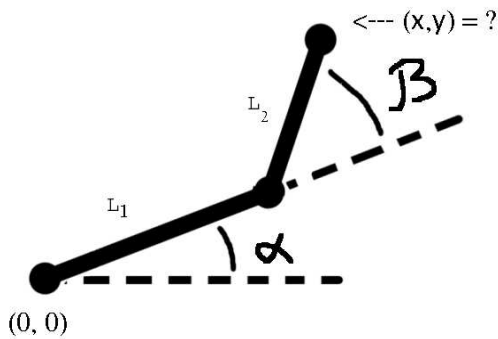
(a) Forward Kinematics (15p)

Write a complete Java program which asks the user to enter two joint angles for a very simple robot. The program must first convert these angles from degrees to radians and then use them to calculate the x and y coordinates of the tip of the robot's second link. The two link lengths are constants: $L_1 = 0.5$ and $L_2 = 0.3$.

Hint: The formulas for x and y are the following:

$$x = L_1 \cos(\alpha) + L_2 \cos(\alpha + \beta)$$

$$y = L_1 \sin(\alpha) + L_2 \sin(\alpha + \beta)$$



(b) Credit Card Number Generator (15p)

Write a complete Java program that generates a random 16-digit credit card number for a Discover card. The first 6 digits of each credit card number are reserved for the issuer number. For Discover cards these digits must be “6011xx”. The remaining ten digits are the account number. Print the credit card number using the standard format: 6011-xxxx-xxxx-xxxx.

Hint: Use the Random class to generate the missing two digits of the issuer number and the ten digits of the account number. You can generate them one at a time.

(c) Loan Calculator (15p)

Write a Java program that calculates the monthly payments for a mortgage loan. The program must perform the following steps: 1) read the loan amount, the number of years, and the annual interest rate from the keyboard; 2) calculate the monthly interest rate from the annual interest rate (divide by twelve); 3) compute and print the monthly payment using the formula given below; 4) compute and print the total payment, which is equal to the monthly payment times 12 times the number of years.

$$\text{monthlyPayment} = \frac{\text{loanAmount} \times \text{monthlyInterestRate}}{1 - \frac{1}{(1 + \text{monthlyInterestRate})^{\text{numberOfYears} \times 12}}}$$

(d) URLs to E-mail Addresses (20p)

Write a program that asks the user to enter a web link (URL) to a person's web site and uses that link to guess the person's e-mail address. For example, if the user entered "http://www.cs.iastate.edu/~john" the program should output "john@cs.iastate.edu". You can assume that the user will always enter the URL in the following format: the first character typed in will be the first letter of the URL; the URL always starts with "http://www."; there is only one '~' in the URL's name; the last character typed in will be the last character of the URL; finally, there will be no spaces in the URL's name. The program must then format and print the e-mail address on the screen. The "www" in the URL must be omitted from the e-mail address as in the example given above.

Hint: Use the methods of the String class to find the positions of the separators in the original string. Then chop that string into separate pieces and print them in the desired order and format.

That's it. Good Luck!

Question	Max	Score
True/False	10	
Short Answer	10	
Arithmetic Expressions	15	
What is the Output	10	
Expressions	20	
Forward Kinematics	15	
Credit Card Numbers	15	
Loan Calculator	15	
URLs to E-mails	20	
TOTAL:	130	