**CSF213 Object Oriented Programming**

**Extra Practise Problems**

**Week 4**

**Loops (While, do-while, for), Nested Loops and Recursive Methods**

**Exercise 1:**

Write a program that takes three command line integers x, y, and z representing your two

blackjack cards x and y, and the dealers face-up card z, and prints the "standard strategy" for a

6 card deck in Atlantic city. Assume that x, y, and z are integers between 1 and 10, representing

an ace through a face card. Report whether the player should hit, stand, or split according to

these strategy tables.

**Exercise 2**

The process of finding the largest value (i.e., the maximum of a group of values) is used

frequently in computer applications. For example, a program that determines the winner

of a sales contest would input the number of units sold by each salesperson. The

the salesperson who sells the most units wins the contest. Write a Java application that

inputs a series of 10 integers and determines and prints the largest integer.

Your program should use at least the following three variables:

a. counter: A counter to count to 10 (i.e., to keep track of how many numbers have been

input and to determine when all 10 numbers have been processed).

b. number: The integer most recently input by the user.

c. largest: The largest number found so far.

**Exercise 3**

Write a Java program to display the following character rhombus structure.

*Test Data*

Input the number: 7

*Expected Output* :

A

ABA

ABCBA

ABCDCBA

ABCDEDCBA

ABCDEFEDCBA

ABCDEFGFEDCBA

ABCDEFEDCBA

ABCDEDCBA

ABCDCBA

ABCBA

ABA

A

**Exercise 4**

In 1769 Euler generalized Fermat's Last Theorem and conjectured that it is impossible to find

three 4th powers whose sum is a 4th power, or four 5th powers whose sum is a 5th power, etc.

The conjecture was disproved in 1966 by exhaustive computer search. Disprove the conjecture

by finding positive integers a, b, c, d, and e such that

a

5 + b

5 + c

5 + d

5= e

5

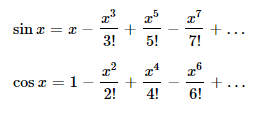
Write a program that reads in a command line parameter N and exhaustively searches for all such solutions with a, b, c, d, and e less than or equal to N. No counterexamples are known for powers greater than 5, but you can join EulerNet, a distributed computing effort to find a counterexample for sixth powers.

**Exercise 5**

Write a program that finds the radii where the probability of finding the electron in the 4s excited state of hydrogen is zero. The probability is given by: (1 - 3r/4 + r2/8 - r3/192)2 e-r/2, where r is the radius in units of the Bohr radius (0.529173E-8 cm). Use Newton's method. By starting Newton's method at different values of r, you can discover all three roots. Hint: use initial values of r= 0, 5,and 13. Challenge: explain what happens if you use an initial value of r = 4 or 12.

**Exercise 6:**

Write a program to find sin x and cos x that computes sin x and cos x using Taylor series expansion

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**Exercise 7:**

In 1693, Samuel Pepys asked Isaac Newton which was more likely: getting at least one 1 when rolling a fair die 6 times or getting at least two 1's when rolling a fair die 12 times. Write a program in java that uses simulation to determine the correct answer.

**Exercise 8:**

Write a Program Binary2.java that is based on the following method: Write 1 if n is odd, 0 if n is even. Divide n by 2, throwing away the remainder. Repeat until n = 0 and read the answer backwards. Use % to determine whether n is even, and use string concatenation to form the answer in reverse order.

**Exercise 9:**

The International Standard Book Number (ISBN) is a 10 digit code that uniquely specifies a book. The rightmost digit is a *checksum* digit which can be uniquely determined from the other 9 digits from the condition that *d1 + 2d2 + 3d3 + ... + 10d10* must be a multiple of 11 (here *di* denotes the ith digit from the right). The checksum digit *d1* can be any value from 0 to 10: the ISBN convention is to use the value X to denote 10. *Example*: the checksum digit corresponding to 020131452 is 5 since is the only value of *d1* between 0 and and 10 for which *d1 + 2\*2 + 3\*5 + 4\*4 + 5\*1 + 6\*3 + 7\*1 + 8\*0 + 9\*2 + 10\*0* is a multiple of 11. Write a program ISBN.java that takes a 9-digit integer as a command-line argument, computes the checksum, and prints the 10-digit ISBN number. It's ok if you don't print any leading 0s.

**Exercise 10:**

S. Ramanujan was an Indian mathematician who became famous for his intuition for numbers. When the English mathematician G. H. Hardy came to visit him in the hospital one day, Hardy remarked that the number of his taxi was 1729, a rather dull number. To which Ramanujan replied, "No, Hardy! No, Hardy! It is a very interesting number. It is the smallest number expressible as the sum of two cubes in two different ways." Verify this claim by writing a program Ramanujan.java that takes an integer command-line argument n and prints all integers less than or equal to n that can be expressed as the sum of two cubes in two different ways - find distinct positive integers *a*, *b*, *c*, and *d* such that *a3 + b3 = c3 + d3*. Use four nested for loops.

Now, the license plate 87539319 seems like a rather dull number. Determine why it's not.