CSE1325 OOP Final Exam

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Instructions:

1. Read all of the instructions for each question and answer what is asked. Do not write down random stuff if you don’t know the answer.
2. All questions that have the same question number are related to each other. However, they are not all necessarily dependent on each other so you can skip around if needed.
3. The test is worth 100 points and there will be 10 points extra credit available.
4. If you have a question during the test, raise your hand and ask the proctor. You may or may not get an answer, but you won’t know unless you ask.

1.a. What characteristics of computer architecture, i.e what things about the computer, would lead you to consider the idea of using multi-threading in your Java program? List at least two computer characteristics that you would consider and describe how each of those characteristics would relate to the use of multi-threading. {5}

Many answers possible incl

Multiple processors available

Special graphics processing available

Built in support for concurrency

1.b. Describe the concept of a Java program “thread” in your own words. {5}

A strand of processing that can take place independently of other parts of the program for some period of time or until some condition occurs

1.c. List and describe at least two Java built-in methods that could be used to allow multi-threading in a program. Tell what class the methods are in and describe each method in no more than two sentences for each in your own words. {8}

wait

notify

notifyall

2.a. In a program with the need for a synchronized producer-consumer relationship between objects, what actions from each object would happen in what order if 4 items are produced and consumed in perfect order? List each action and its associated object on a separate line below. The first action is listed for you. {7 points}

Object Action

Producer produces item #1

Consumer uses item #1

Producer produces item #2

Consumer uses item #2

Producer produces item #3

Consumer uses item #3

Producer produces item #4

Consumer uses item #4

2.b. In a program with the need for a synchronized producer-consumer relationship between objects, what should the consumer object do if the appropriate item is not available to be consumed?

Describe what should happen in words. {5 points}

Consumer should check to see if item is available and should wait if item is not available yet. Consumer should continue to check or should listen for a notify or notifyAll command and when item is available, then consumer should use it.

3. Given the classes GUIGuessingGameTest and GameFrame on the handouts with the test, answer the following questions:

3.a. What is the game implemented by the program? Describe in words and be specific. {4 points}

The program picks a number between 0 and 1000. The user then gives guesses for that number. The program responds with hints (“greater” or “smaller”) and states “You got it!” when the user arrives at the correct value. The game also counts the number of guesses.

3.b. Draw the GUI window that is shown after the user has entered a 4th guess of 392. Use light horizontal and vertical lines to show how the items line up with one another on the GUI. Put dimensions on the outside of your GUI window to indicate the height and width and the measurement unit of the overall window. {8 points}

Drawing must include:

Try to guess the selected integer between 0 and 1000

My guess is: 392

This is your guess number 4

Your guess is greater than the selected integer (or smaller or “got it”)

*Bonus points: Given during test {+3 pts}*

*On 3.b draw the GUI window as specified AND then specify a “selected integer” value that would work for the results you put in your GUI window.*

Possible answers would be :

If results = “Your guess is greater than the selected integer ” then value must be less than 392

If results = “Your guess is smaller than the selected integer ” then value must be greater than 392

If results = “You got it!” then value must be 392

3.c. Given the algorithm of the game, what is the maximum number of guesses needed to win the game, if every guess is made as efficiently as possible? How do you determine this number of guesses and what is the process used to decide what to guess each time? {7 points}

Max number of guesses would be 10

In 10 guesses you can cover 2^^10 values (1024 values) so that is less that 1000 values you are using

You should implement binary search in effect and guess the middle value of the range each time

3.d. How do you test a piece of software repeatedly with the same values, when the code uses a random number generator to create a starting number for each run? {4 pts}

Use the same seed for the random number generator to create the same sequence of numbers on each run.

3.e. Given the data fields and layout for GameFrame and the addMyComponent method, what does the command

addMyComponent( guessCountNum, 2, 3, 1, 1 );

cause to happen? Describe the information in the object data field that is used, at what location it is used, the sizes of the data in the layout, etc. {7 pts}

This call to addMyComponent puts the value of guessCountNum onto the GUI window. The window uses GridBagLayout so the location for guessCountNum would be in row 2 and column 3 and the size of this value would be 1 row tall by 1 column wide.

4. Fill in the blank with the capital letter of the phrase on the right that best relates to the word or phrase on the left. {2 points each; 10 points total}

B a. Multi-threading A. Data-generating object

A b. Producer B. Concurrency

D c. Lock C. Data-using object

E d. Synchronize D. Prevent simultaneous access

C e. Consumer E. Force ordered interactions

5. Given the classes MTF14 and MTF14Test on the handouts with the test, answer the following questions: [Note: These are exactly the same classes used on the midterm test.]

5.a. What does the method prAL in the test class do? Describe this method in terms of the real-life application that this program is modeling. {5 pts}

[Example: Don’t say “method prAL is checking to see if x is less than y and greater than k” . Say “method prAL is checking to see if x is within the bounds of legal values for this component. This component must have n digits and cannot start with 0. Therefore the lowest legal value is k and the highest legal value is y so x must be between them to be legal.”]

The method prAL prints the entire ArrayList of values where each value is formatted as xxx-xxx-xxxx with one value per line.

5.b. Explain why prAL is a static method. {3 pts}

prAL makes no changes to any data in the test class or otherwise and

it is called in a static main method.

5.c. Is there error checking done on input parameters to the constructor? Circle YES or NO

If YES,

list which parameters are error checked and explain why the others are not checked.

If NO,

explain whether or not this is appropriate for the particular task being performed.

{5 pts}

YES

All three input parameters to the constructor ac3, exC3, and ln4 are error checked by calling their set functions rather than storing them directly in the MTF14 data fields.

5.d. For the parameter exC3, list and describe in words all the error checks that are performed in the set method for this parameter.

{5 pts}

Set method initially sets object datafield exC3 to 272 as its default value.

Then the set method checks the exC3 parameter to see if it is greater than 199 and less than or equal to 999. This insures that three digits start with a digit from 2 to 9 and that the value is only three digits and not four or more digits.

If the previous checks are OK, then the set function checks to see if ac3’s 2nd digit (ac3 % 10) is equal to 1 and if ac3’s 3rd digit ((ac3 /10 )% 10) is also equal to 1. If this is true, the exC3 value is invalid and the method returns false. Otherwise the method sets the datafield exC3 to the parameter value exC3 and returns true.

[In writing this answer I discovered that I wrote “ac3” in this section of code when I meant “exC3”. Apparently I did not do enough testing. This is supposed to eliminate phone numbers that have two 1’s in the middle three digits of the number like xxx-911-xxxx or xxx-411-xxxx ]

5.e. Given what MTF14 represents in the real world (as discussed in class after the midterm), write a few lines of code (a code fragment) that would implement at least one change that should be made to the code to handle a valid MTF14 object in the real world that is not handled currently. Also describe in words the reason for the change that you are making and also describe exactly where the new code fragment should be added to the MTF14 code. {6 pts}

MTF14 represents phone numbers

In setAC3, the code assumes that any area code of the form kxx (k >2 and k <= 9) can be replaced with 800 – which is an area code where the owner of the phone number pays the extra for long-distance charges. This is not really true. Kxx would also cover the form of 900 numbers, caller-paid numbers, as well 911 and 411 three digit codes. The setAC3 method should check more specific cases. One such change would be to change the code block inside the second if { this.aC3 = 800; setAC3 = false; } to something like: [NOTE: This is just an example. Only one case is required to be dealt with.]

{

switch (aC3)

{ case 900: case 888: case 877:

case 800: this.aC3 = aC3;

break;

default: setAC3 = 800;

setAC3 = false;

}

}

6. Given the interface named *Prioritize* below that has a method called *determinePriority*, write an implementation of the method determinePriority that uses the two input values to return a priority value determined as follows:

val1 is treated as a ranking value in the range of 1 to 5 with 5 being the highest rank and

val2 used as a weighting in the range of 1 to 100 which will potentially reduce the ranking value

The calculation of val1 \* val2 / 100 is done and

returned by the method as a double priority value in the range of 1.0 to 5.0. (0.0 to 5.0)

{6 points}

public interface Prioritize {

public double determinePriority(int val1, int val2);

}

public double determinePriority(int val1, int val2)

{ double priority = 0.0; // question doesn’t specify what to do with erroneous weightings

if ((val1 > 0) && (val1 < 6))

{ if ((val2 > 0) && (val2 <101))

{ priority = val1 \* val2 / 100.0; } }

return priority;

}

Extra Credit questions

XC1. Give an example of a situation in real-life where actions occur concurrently such that a computer simulation of that situation would need to have multiple threads to model it. Describe what would be running in each separate thread. {5 pts}

XC2. Considering the real-life application of the MTF14 objects today, what information does aC3 carry? Does aC3 carry the same amount of information now as it did when the system using it was developed? What used to be true about the aC3 information that is now no longer consistently true? {3 pts}

aC3 is the area code. Initially it reflected where in the country a phone was and it was based on location. Now numbers are portable and not tied to a place.

XC3. From the Java course this semester, what topic would you have liked to spend more time on or what topic was not covered that you would have liked to have covered about Java?

{Any meaningful answer will receive 2 points. ANY answer will receive at least 1 point.)