bs00580_ CS 113 – Basic Data Structures and Algorithms

Time Complexity Exercises (35 points)

Due: Wed. 2/24/2020 by 11:45 pm (manual upload to GitHub)

**Edit your answers into this file and upload the completed worksheet to GitHub.**

1. UML Diagrams (10 points)
   1. Create a UML diagram with 6 classes (make up the classes). The classes should be related to a home stereo. Show both composition and inheritance. Each class should have at least two attributes and two methods.
2. Sequence Diagram (5 points)
   1. Create a basic sequence diagram of preparing a meal (getting ingredients, cooking etc.)
3. Big-O notation (10 points)
   1. Rank the following in order of increasing run times, if they are same list them together.
      1. O(N)
      2. O()
      3. O(NM)
      4. O()
      5. O(5)
      6. O(N2)
      7. O(log N)
      8. O(N log N)
      9. O(0)
      10. O(N4)
      11. O(2/N)
      12. O(2N)
      13. O(N1.5)
   2. What is the complexity of the following pieces of code? (Answer using Big O notation) (10 points)

sum = 0;

**for** (i = 0; i < n; i++) {

sum++;

}

sum = 0;

**for** (i = 0; i < n; i++) {

**for** (j = 0; j < n; j++) {

sum++;

}

}

sum = 0;

**for** (i = 0; i < n; i++) {

**for** (j = 0; j < i; j++) {

sum++;

}

}

sum = 0;

**for** (i = 0; i < n \* n; i++) {

**for** (j = 0; j < n \* n; j++) {

sum++;

}

}

UML Diagram:

|  |
| --- |
| Source |
| * source : String * bluetooth : boolean * hdCable : boolean * avCable : boolean |
| + powerOn() : void  + powerOff() : void  + setSource(source : String) : void  + getSource() : String  + hasBlueTooth() : boolean |

|  |
| --- |
| Reciever  (Extends Source) |
| * brand : String * watts : int * numChannels : int * numSupportedSpeakers : int * volume : int |
| + powerOn() : void  + powerOff() : void  + setNumChannels(num : int) : void  + getNumChannels() : int  + setNumSupportedChannels(num : int) : void  + getNumSupportedChannels() : int  + setWatts(watts : int) : void  + getWatts() : int  + setVolume(num : int) : void  + getVolume() : int  + setBrand(brand : String) : void  + getBrand() : String |

|  |
| --- |
| Television  (Extends Source) |
| * brand : String * hd : Boolean * channel : int * size : double |
| + setBrand(brand : String) : void  + getBrand() : String  + setHDEnabled(enabled : boolean) : void  + getHDEnabled() : boolean  + setChannel(channel : int) : void  + getChannel() : int  + setSize(size : int) : void  + getSize() : int  + powerOn() : void  + powerOff() : void |

|  |
| --- |
| Radio  (Extends Source) |
| * brand : String * bluetooth : boolean * frequency : double * amFM : String |
| + setBrand(brand : String) : void  + getBrand() : String  + hasBluetooth() : boolean  + setBluetooth(set : boolean) : void  + setFrequency(frequency : double) : void  + getFrequency() : double  + setamFM(amFM : String) : void  + getamFM() : String  + powerOn() : void  + powerOff() : void |

|  |
| --- |
| Amplifier  (Extends Source) |
| * brand : String * watts : int * avCable : boolean |
| + powerOn() : void  + powerOff() : void  + hasBluetooth() : boolean  + setBluetooth(set : boolean) : void  + getBlueToothSource() : Object  + hasAVCable() : boolean  + setAVCable(set : boolean) : void |

|  |
| --- |
| Stereo |
| * brand : String * dolbyNum : double * watts : int * volume : int * hasAmp : boolean * source : Object |
| + powerOn() : void  + powerOff() : void  + hasAmp() : boolean  + setAmp(amp : Amplifier) : void  + getAmp() : Amplifier  + setBrand(brand : String) : void  + getBrand() : String  + getDolbyNum() : double  + setDolbyNum(num : double) : void  + setWatts(watts : int) : void  + getWatts() : int  + setVolume(volume : int) : void  + getVolume() : int  + setSource(source : Object) : void  + getSource() : Object |

isSatisfied

eatFood

isBurnt

FinishedMeal

checkFood new

cookIngredients

addIngredients

MealCreation

1. O(N) = O(5) = O(0) = O(NM)
2. O(log N) = O(sqrtN)
3. O(n^2)
4. O(N log N)
5. O(n^3)
6. O(2^n)
7. O(infinite)

B: 1) O(N)

2) O(2N^2)

3) O(3N^2)

4) O(3N^4)