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Кафедра автоматизованих систем обробки
інформації та управління

ЗВІТ

до лабораторної роботи № 6
з предмету:

„ОСНОВИ ТЕХНОЛОГІЙ ПРОГРАМУВАННЯ”

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(посада, прізвище, ім’я, по батькові)

Київ 2018

ЗМІСТ

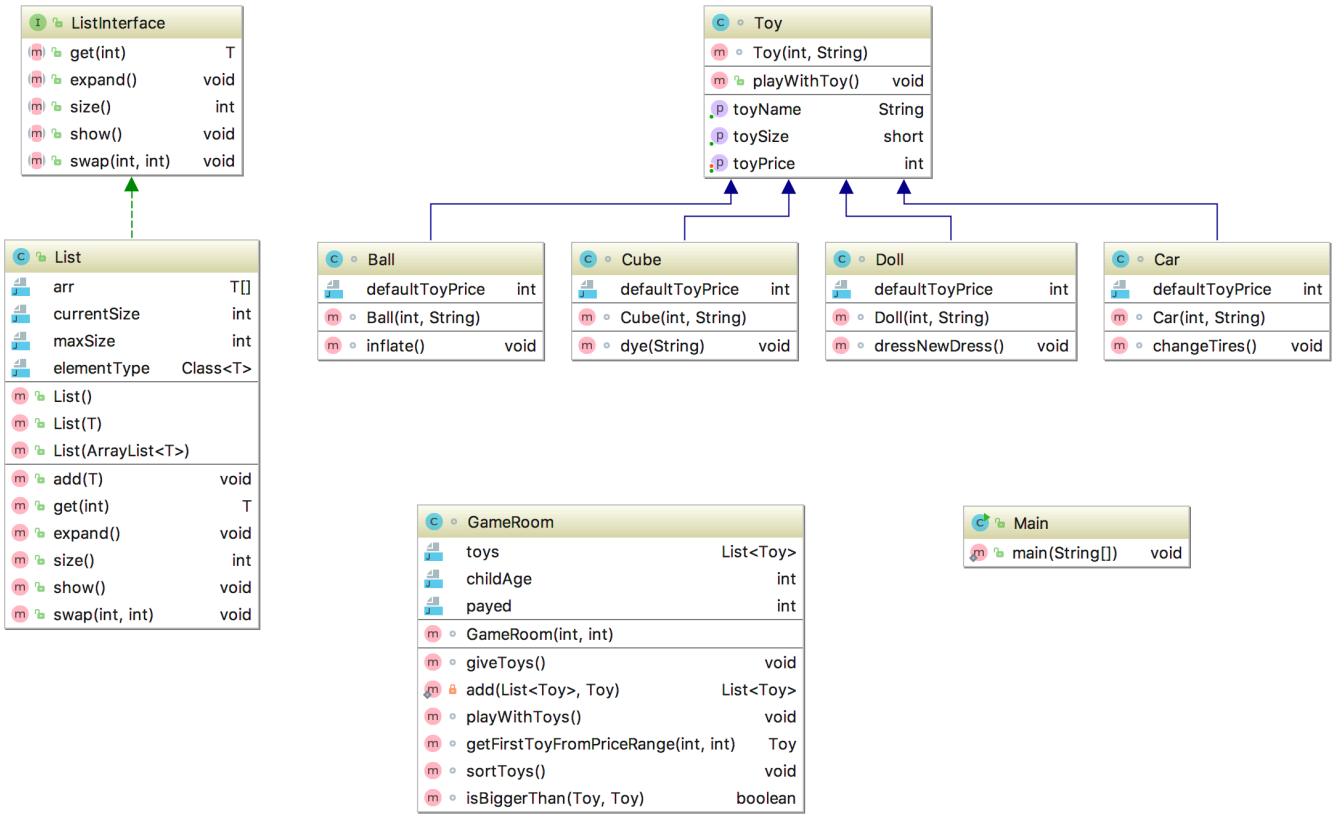
1. ПОСТАНОВКА ЗАДАЧІ

Створити клас, що описує типізовану колекцію (типом колекції є узагальнений клас з лабораторної роботи No5), що реалізує заданий варіантом інтерфейс (п.2) та має задану внутрішню структуру (п.3). Реалізувати всі методи інтерфейсу, а також створити не менше ніж 3 конструктори (1 – порожній, 2 – в який передається 1 об’єкт узагальненого класу, 3 – в який передається стандартна колекція об’єктів, наприклад, ArrayList). Всі початкові дані задаються у виконавчому методі. Код повинен відповідати стандартам JCC та бути детально задокументований.

Інтерфейс – List

Внутрішня структура колекції – масив із початковою кількістю елементів 15 та збільшенням кількості елементів на 30%

2. ДІАГРАМА КЛАСІВ



3. ВИСНОВОК

Складнощів з реалізацією спискової структури з використанням масиву у лабораторній роботі не виникло, всі стандартні зв’язні структури даних були замінені власним списком без виявлення помилок.

4. КОД ПРОГРАМИ

```java
/**
 * Java labs – Lab6
 * @version 1.0 2018-04-03
 * @author Misha Kushka
 */

import java.lang.reflect.Array;
import java.util.ArrayList;

/**
 * Implementation of the real-world toy with it's
 * properties such as size, type, color and such things
 * to do with it as playing with toy.
 */
class Toy {

    private short toySize; // size of the toy
    private int toyPrice; // price of the toy
    public final String toyName; // name of the toy

    /**
     * Toy's constructor, which sets toy's name
     * depending on the child age.
     *
     * @param childAge Age of the child.
     * @param newToyName Part of the toy name without
     * appendix of it's size.
     */
    Toy(int childAge, String newToyName) {
        if (childAge <= 5) {
            toySize = 1;
            newToyName = "small " + newToyName;
        } else if (childAge > 5 && childAge <= 10) {
            toySize = 2;
            newToyName = "medium " + newToyName;
        } else {
            toySize = 3;
            newToyName = "big " + newToyName;
        }

        toyName = newToyName;
    }

    /**
     * Immitates process of playing with toy.
     */
    public void playWithToy() {
        System.out.println("Now child is playing with the " + toyName + ".");
    }

    /**
     * Setter for the toy price.
     * @param newPrice New price of the toy to set.
     */
    public void setToyPrice(int newPrice) {
        toyPrice = newPrice;
    }

    /**
     * Getter for the toy size.
     * @return Size of the toy.
     */
```

```
    public short getToySize() {
        return toySize;
    }

    /**
     * Getter for the toy prise.
     * @return Price of the toy.
     */
    public int getToyPrice() {
        return toyPrice;
    }

    /**
     * Getter for the toy name.
     * @return Toy's name.
     */
    public String getToyName() {
        return toyName;
    }

}


/**
 * Ball toy for girls & boys of different ages.
 */
class Ball extends Toy {

    private int defaultToyPrice = 1; // price of the toy, not considering child age

    /**
     * Call's the constructor of the parent's Toy class,
     * sets toy's price, which isn't depends on the age
     * of the child.
     *
     * @param childAge Age of the child.
     * @param newToyName Name of the toy.
     */
    Ball(int childAge, String newToyName) {
        super(childAge, newToyName);
        setToyPrice(defaultToyPrice);
    }

    /**
     * Some another method for this class.
     */
    void inflate() {
        System.out.println("Inflate the ball.");
    }

}


/**
 * Car toy for boys of different ages.
 */
class Car extends Toy {

    private int defaultToyPrice = 3; // price of the toy, not considering child age

    /**
     * Call's the constructor of the parent's Toy class,
     * sets toy's price depends of the default toy price
     * and age of the child.
     *
```

```
     * @param childAge Age of the child.
     * @param newToyName Name of the toy.
     */
    Car(int childAge, String newToyName) {
        super(childAge, newToyName);
        setToyPrice(defaultToyPrice * getToySize());
    }

    /**
     * Some another method for this class.
     */
    void changeTires() {
        System.out.println("Now your car is equiped with the new tires.");
    }

}


/**
 * Cube toy for girls & boys of different ages.
 */
class Cube extends Toy {

    private int defaultToyPrice = 4; // price of the toy, not considering child age

    /**
     * Call's the constructor of the parent's Toy class,
     * sets toy's price depends of the default toy price
     * and age of the child.
     *
     * @param childAge Age of the child.
     * @param newToyName Name of the toy.
     */
    Cube(int childAge, String newToyName) {
        super(childAge, newToyName);
        setToyPrice(defaultToyPrice * getToySize());
    }

    /**
     * Some another method for this class.
     */
    void dye(String color) {
        System.out.println("Now color of the your cube is " + color + ".");
    }

}


/**
 * Doll toy for girls of different ages.
 */
class Doll extends Toy {

    private int defaultToyPrice = 5; // price of the toy, not considering child age

    /**
     * Call's the constructor of the parent's Toy class,
     * sets toy's price depends of the default toy price
     * and age of the child.
     *
     * @param childAge Age of the child.
     * @param newToyName Name of the toy.
     */
    Doll(int childAge, String newToyName) {
        super(childAge, newToyName);
```

```
        setToyPrice(defaultToyPrice * getToySize());
    }

    /**
     * Some another method for this class.
     */
    void dressNewDress() {
        System.out.println("Now your doll wears in the new dress.");
    }

}


/**
 * Implementation of the gaming room for children
 * of different ages.
 */
class GameRoom {

    private List<Toy> toys = new List<>(); // array of toys in the game room
    private int childAge; // age of the child
    private int payed; // how much was payed for the room

    /**
     * Allow to pay for playing in the game room.
     * Depending on the amount of money child can
     * play with different number of toys.
     *
     * @param amount Amount of money to pay for playing.
     * @param age Age of the child in the room.
     */
    GameRoom(int amount, int age) {
        // Too low payment checker.
        if (amount < 1) {
            System.err.println("Sorry, but the cheapest toy costs $1.");
            System.exit(1);
        }
        childAge = age;
        payed = amount;

        // Fill toys array with toys.
        giveToys();

        // Show how many toys are available depends of the payed amount.
        try {
            System.out.println("Now you can play with " + toys.size() + " toys.");
        } catch (NullPointerException e) {
            System.err.println("Add elements to the toys array first.");
            System.exit(2);
        }
    }

    /**
     * Fill the toys array with different toys object's
     * depends of the payed amount for the room.
     */
    void giveToys() {

        // Toys, which are in the room.
        List<Toy> defaultToys = new List<>();

        defaultToys.add(new Car(childAge, "super car"));
        defaultToys.add(new Doll(childAge, "cool doll"));
        defaultToys.add(new Ball(childAge, "amazing ball"));
        defaultToys.add(new Cube(childAge, "crazy cube"));
```

```
    int[] defaultToyPrices = new int[defaultToys.size()]; // prices of toys in the room

    // Set prices for all toys in the room depending on the child age.
    for (int i = 0; i < defaultToyPrices.length; i++) {
        defaultToyPrices[i] = defaultToys.get(i).getToyPrice();
    }

    int totalPrice = 0; // total price of all toys for the current child
    int iteration = 0; // number of iterations of adding toys

    // A little bit randomly choose toys for the particular child
    // depending on the child age and payed amount.
    while (totalPrice < payed) {
        switch (iteration%4) {
            case 0:
                if (totalPrice + defaultToyPrices[0] <= payed) {
                    toys = add(toys, defaultToys.get(0));
                    totalPrice += defaultToyPrices[0];
                }
                break;
            case 1:
                if (totalPrice + defaultToyPrices[1] <= payed) {
                    toys = add(toys, defaultToys.get(1));
                    totalPrice += defaultToyPrices[1];
                }
                break;
            case 2:
                if (totalPrice + defaultToyPrices[2] <= payed) {
                    toys = add(toys, defaultToys.get(2));
                    totalPrice += defaultToyPrices[2];
                }
                break;
            default:
                if (totalPrice + defaultToyPrices[3] <= payed) {
                    toys = add(toys, defaultToys.get(3));
                    totalPrice += defaultToyPrices[3];
                }
                break;
        }
        iteration++;
    }

    System.out.println("Total price: $" + totalPrice);

}

/**
 * Add element to the Toy's array.
 *
 * @param originalArray Array to put element into.
 * @param newItem Element to put.
 * @return New array with added element.
 */
private static List<Toy> add(List<Toy> originalArray, Toy newItem) {
    int currentSize = originalArray.size();
    int newSize = currentSize + 1;
    List<Toy> tempArray = new List<>();
    for (int i = 0; i < currentSize; i++) {
        tempArray.add(originalArray.get(i));
    }
    tempArray.add(newItem);
    return tempArray;
}
```

```java
/**
 * Execute method of playing with all toys
 * of the particular child.
 */
void playWithToys() {
    for (int i = 0; i < toys.size(); i++) {
        toys.get(i).playWithToy();
    }
}

/**
 * Get first toy from the setted range by toy's price.
 *
 * @param min Minimum price of the toy to find.
 * @param max Maximum price of the toy to find.
 * @return First toy with price from range if found,
 * or null otherwise.
 */
Toy getFirstToyFromPriceRange(int min, int max) {

    // Check is min < max.
    if (min > max) {
        System.out.println("Attention! min value is bigger, than max value!");
    }

    // Iteratively find toy from the given range.
    for (int i = 0; i < toys.size(); i++) {
        if (toys.get(i).getToyPrice() >= min && toys.get(i).getToyPrice() <= max) {
            return toys.get(i);
        }
    }

    return null;
}

/**
 * Sort toys by the name of their classes alphabetically.
 */
void sortToys() {
    int i, j; // iterators
    int n = toys.size(); // length of the toys array
    Toy temp; // temporary Toy object to swap elements

    // Bubble sort for the array of toys.
    for (i = 0; i < n-1; i++) {
        for (j = 0; j < n - i - 1; j++) {
            if (isBiggerThan(toys.get(j), toys.get(j+1))) {
                toys.swap(j, j+1);
            }
        }
    }
}

boolean isBiggerThan(Toy first, Toy second) {
    int firstIndex, secondIndex;

    // Align class names with indexes.
    // First object.
    switch (first.getClass().getName()) {
        case ("Ball"):
            firstIndex = 0;
            break;
        case ("Car"):
            firstIndex = 1;
            break;
```

```
            case ("Cube"):
                firstIndex = 2;
                break;
            default:
                firstIndex = 3;
        }

        // Second object.
        switch (second.getClass().getName()) {
            case ("Ball"):
                secondIndex = 0;
                break;
            case ("Car"):
                secondIndex = 1;
                break;
            case ("Cube"):
                secondIndex = 2;
                break;
            default:
                secondIndex = 3;
        }

        if (firstIndex > secondIndex)
            return true;

        return false;
    }

}


/**
 * List interface with it's main methods.
 * @param <T> Generic parameter.
 */
public interface ListInterface<T> {

    /**
     * Get array's element by index.
     * @param index Index of searching element.
     * @return Element from array by index.
     */
    public T get(int index);

    /**
     * Expand the array, if it's too small.
     */
    public void expand();

    /**
     * Get current size of the array.
     * @return Size of the array.
     */
    public int size();

    /**
     * Show the array on the screen.
     */
    public void show();

    /**
     * Swap elements in the list.
     * @param i Index of the first element.
     * @param j Index of the second element.
     */
```

```
    public void swap(int i, int j);

}


/**
 * List implementation with it's main methods.
 * @param <T> Generic parameter.
 */
public class List<T> implements ListInterface<T> {

    private T[] arr; // array to store items in the list
    private int currentSize; // current length of the array
    private int maxSize; // current maximum size of the array
    private Class<T> elementType; // type of elements in the array

    /**
     * List class constructor with one parameter: type of elements.
     */
    public List() {
        maxSize = 15;
        currentSize = 0;
    }

    /**
     * List constructor with 2 parameters: type of elements and one element.
     * @param element Element to add to the list.
     */
    public List(T element) {
        maxSize = 15;
        currentSize = 1;
        elementType = (Class<T>) element.getClass().getSuperclass();
        arr = (T[]) Array.newInstance(elementType, maxSize);
        arr[0] = element;
    }

    /**
     * Add element to the end of the array.
     * @param element Element to push.
     */
    public void add(T element) {
        // Expand array if it's too small
        if (currentSize >= maxSize) {
            expand();
        }

        if (elementType == null) {
            elementType = (Class<T>) element.getClass().getSuperclass();
            arr = (T[]) Array.newInstance(elementType, maxSize);
        }

        arr[currentSize] = element;
        currentSize++;
    }

    /**
     * List constructor with 2 parameters: type of elements and array of elements
     * to put in this structure.
     * @param newArr Array to put to the list.
     */
    public List(ArrayList<T> newArr) {
        maxSize = 15;
        currentSize = newArr.size();

        // Array is not empty
```

```
    if (currentSize != 0) {
        elementType = (Class<T>) newArr.get(0).getClass().getSuperclass();

        while (newArr.size() > maxSize) {
            expand();
        }

        arr = (T[]) Array.newInstance(elementType, maxSize);

        for (int i = 0; i < newArr.size(); i++) {
            arr[i] = newArr.get(i);
        }
    }
}

/**
 * Get array's element by index.
 * @param index Index of searching element.
 * @return Element from array by index.
 */
public T get(int index) {
    if (index >= 0 && index < currentSize) {
        return arr[index];
    } else {
        System.err.println("Index is out of range");
    }

    return (T) null;
}

/**
 * Expand the array, if it's too small.
 */
public void expand() {
    int newSize = maxSize + (int)(maxSize * 0.3);
    T[] newArr = (T[]) Array.newInstance(elementType, newSize);

    System.arraycopy( arr, 0, newArr, 0, maxSize);

    maxSize = newSize;
    arr = newArr;
}

/**
 * Get current size of the array.
 * @return Size of the array.
 */
public int size() {
    return currentSize;
}

/**
 * Show the array on the screen.
 */
public void show() {
    for (int i = 0; i < currentSize; i++) {
        System.out.println(arr[i]);
    }
}

/**
 * Swap elements in the list.
 * @param i Index of the first element.
 * @param j Index of the second element.
 */
```

```
    public void swap(int i, int j) {
        if (i >= 0 && i < currentSize && j >= 0 && j < currentSize) {
            T temp = arr[i];
            arr[i] = arr[j];
            arr[j] = temp;
        } else {
            System.err.println("One or both of indexes are out of range.");
        }
    }

}


public class Main {

    public static void main(String[] args) {

        // Init game room's object to play with it.
        GameRoom gameRoom = new GameRoom(23, 9);

        gameRoom.playWithToys();

        System.out.println("\n-- SORTED ------------------------------");

        gameRoom.sortToys();
        gameRoom.playWithToys();

        System.out.println();

        int min = 10;
        int max = 13;

        Toy firstToyFromRange = gameRoom.getFirstToyFromPriceRange(min, max);

        if (firstToyFromRange != null) {
            System.out.println("Toy from " + min + " to " + max + " is " +
firstToyFromRange.getToyName() + ".");
        } else {
            System.out.println("There is no toys from range (" + min + ", " + max + ")");
        }

    }

}
```