AP® Computer Science A
2009 Canonical Solutions

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Question 1: Number Cube

PART A:

/** Returns an array of the values obtained by tossing a number cube numTosses times. 
   * @param cube a NumberCube 
   * @param numTosses the number of tosses to be recorded 
   * Precondition: numTosses > 0 
   * @return an array of numTosses values 
   */

public static int[] getCubeTosses(NumberCube cube, int numTosses) 
{ 
    int[] cubeTosses = new int[numTosses]; 
    for (int i = 0; i < numTosses; i++) 
    { 
        cubeTosses[i] = cube.toss(); 
    } 
    return cubeTosses; 
}
PART B:

/**
   * Returns the starting index of a longest run of two or more
   * consecutive repeated values in the array values.
   * @param values an array of integer values representing a series
   *    of number cube tosses
   *    Precondition: values.length > 0
   *    @return the starting index of a run of maximum size;
   *          -1 if there is no run
   */
public static int getLongestRun(int[] values)
{
    int currentLen = 0;
    int maxLen = 0;
    int maxStart = -1;
    for (int i = 0; i < values.length-1; i++)
    {
        if (values[i] == values[i+1])
        {
            currentLen++;
            if (currentLen > maxLen)
            {
                maxLen = currentLen;
                maxStart = i - currentLen + 1;
            }
        }
        else
        {
            currentLen = 0;
        }
    }
    return maxStart;
}
PART B (ALTERNATE SOLUTION I):

public static int getLongestRun(int[] values) {
    int maxStart = -1;
    int maxLen = -1;
    int currentLen = 0;
    int currVal = -1;
    int currStart = 0;
    for (int i = 0; i < values.length; i++) {
        if (values[i] == currVal)
            currentLen++;
        else {
            if (currentLen > maxLen) {
                maxLen = currentLen;
                maxStart = currStart;
            }
            currStart = i;
            currentLen = 1;
            currVal = values[i];
        }
    }
    if (currentLen > maxLen) {
        maxLen = currentLen;
        maxStart = currStart;
    }
    if (maxLen == 1)
        return -1;
    else
        return maxStart;
}
Question 1: Number Cube (continued)

PART B (ALTERNATE SOLUTION II):  
public static int getLongestRun(int[] values)  
{  
    int maxLen = 0;  
    int currLen = 0;  
    int index = -1;  
    int currVal = -1;  
    for (int i = values.length - 1; i >= 0; i--)  
    {  
        if (values[i] == currVal)  
            currLen++;  
        else  
        {  
            if (maxLen < currLen)  
            {  
                maxLen = currLen;  
                index = i+1;  
            }  
            currVal = values[i];  
            currLen = 1;  
        }  
    }  
    if (maxLen < currLen)  
    {  
        maxLen = currLen;  
        index = 0;  
    }  
    if (maxLen == 1)  
        return -1;  
    return index;  
}
Question 2: Stockpile Critter

public class StockpileCritter extends Critter {
    /** Energy stockpile, initialized to 0. */
    // Instance variable auto-initialized so =0 not necessary.
    private int stockpile = 0;

    /** Default constructor sufficient; no constructors needed. */
    // public StockpileCritter() {stockpile = 0;}

    /** Overridden to address stockpile behavior. */
    public void processActors(ArrayList<Actor> actors) {
        this.stockpile += actors.size();
        for (Actor a : actors)
            a.removeSelfFromGrid();

        this.stockpile--;
    }

    /** Overridden to address stockpile behavior. */
    public Location selectMoveLocation(ArrayList<Location> locs) {
        if (this.stockpile < 0)
            return null;
        else
            return super.selectMoveLocation(locs);
    }
}
PART A:

/** Determines the total cost to charge the battery starting  
 * at the beginning of startHour.  
 * @param startHour the hour at which the charge period begins 
 *    Precondition: 0 ≤ startHour ≤ 23  
 * @param chargeTime the number of hours the battery needs to be charged 
 *    Precondition: chargeTime > 0  
 * @return the total cost to charge the battery  
 */
private int getChargingCost(int startHour, int chargeTime)
{
  int cost = 0;
  for (int x = 0; x < chargeTime; x++)
  {
    cost += this.rateTable[(startHour + x) % 24];
  }
  return cost;
}

PART B:

/** Determines start time to charge the battery at the lowest  
 * cost for the given charge time.  
 * @param chargeTime the number of hours the battery needs to be charged 
 *    Precondition: chargeTime > 0  
 * @return an optimal start time, with 0 ≤ returned value ≤ 23  
 */
public int getChargeStartTime(int chargeTime)
{
  int startTime = 0;
  for (int i = 1; i < 24; i++)
  {
    if (this.getChargingCost(i, chargeTime)  
      < this.getChargingCost(startTime, chargeTime))
    {
      startTime = i;
    }
  }
  return startTime;
}
PART A:

/** Determines where to insert tile,  
 *  in its current orientation, into game board  
 * @param tile the tile to be placed on the game board  
 * @return the position of tile where tile is to be inserted:  
 *  0 if the board is empty;  
 * -1 if tile does not fit in front, at end,  
 *  or between any existing tiles;  
 *  otherwise, 0 ≤ position returned ≤ board.size()  
 */
private int getIndexForFit(NumberTile tile)
{
    if ((this.board.size() == 0) ||
        (tile.getRight() == this.board.get(0).getLeft()))
        return 0;
    for (int i = 1; i < this.board.size(); i++)
    {
        if (tile.getLeft() == this.board.get(i-1).getRight() &&
            tile.getRight() == this.board.get(i).getLeft())
            return i;
    }
    if (tile.getLeft() == this.board.get(this.board.size() - 1).getRight())
        return this.board.size();
    return -1;
}
PART B:

/** Places tile on the game board if it fits (checking all possible * tile orientations if necessary).
 * If there are no tiles on the game board, * the tile is placed at position 0.
 * The tile should be placed at most 1 time.
 * Precondition: board is not null * @param tile the tile to be placed on the game board * @return true if tile is placed successfully; false otherwise *
 * Postcondition: the orientations of the other tiles on the board * are not changed *
 * Postcondition: the order of the other tiles on the board * relative to each other is not changed */

public boolean insertTile(NumberTile tile) {
  int index = getIndexForFit(tile);
  int test = 1;
  while (index == -1 && test < 4) {
    tile.rotate();
    index = getIndexForFit(tile);
    test++;
  }
  if (index != -1)
    this.board.add(index, tile);

  return (index != -1);
}