



AP[®] Computer Science A 2007 Scoring Guidelines

AP[®] COMPUTER SCIENCE A 2007 SCORING GUIDELINES

Question 1: Self Divisor

Part A:	isSelfDivisor	4 points
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- +2 loop over digits
 - +1 access digit *in context of loop*
 - +1/2 attempt (`number % ?` or successfully convert to string represent)
 - +1/2 correct
 - +1 process all digits
 - +1/2 attempt (process multiple digits)
 - +1/2 correct
- +2 classify number
 - +1/2 return false if find 0 digit
 - +1/2 test if divisible (`number % digit`)
 - +1/2 return false if find non-divisor digit
 - +1/2 return true self divisor

} lose both of these if return a value in both cases of an if-else

Part B:	firstNumSelfDivisors	5 points
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- +1 initialize
 - +1/2 create and initialize array of size `num`
 - +1/2 create and initialize index counter
- +3 1/2 loop to find self divisors
 - +1/2 iterate through numbers beginning with `start`
 - +1/2 call `isSelfDivisor` on number
 - +1 1/2 add self divisor to array
 - +1/2 attempt (store self divisor in some array index)
 - +1 correct (store in correct index, including increment)
 - +1 loop and store `num` values in array
 - +1/2 attempt (must reference index counter and `num`)
 - +1/2 correct
- +1/2 return array (lose this if return first time through loop)

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**AP[®] COMPUTER SCIENCE A
2007 SCORING GUIDELINES**

Question 2: Pounce Fish (MBS)

Part A:	findFish	5 points
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- +2 access & check neighbor
 - +1/2 determine current location
 - +1/2 determine current direction
 - +1/2 correctly access any neighbor
 - +1/2 determine if neighbor location is empty
- +1 1/2 loop in forward direction
 - +1/2 loop with respect to range
 - +1 access up to range consecutive forward locations (as needed)
- + 1 1/2 return value
 - +1/2 return null if reach invalid location in loop
 - +1/2 return object at first non-empty location in loop
 - +1/2 return null if no non-empty location in loop

Special Usage:

- 1 missing or incorrect environment access

Part B:	act	4 points
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- +1/2 call findFish()
- +1/2 test if findFish returned null
- +2 not null case
 - +1 prey.die() or environment().remove(preY)
 - +1 change location to prey's location
- +1 null case
 - +1/2 attempt to act (move() or super.move() OK)
 - +1/2 super.act()

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Question 3: Answer Sheets

Part A:	getScore	4 1/2 points
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- +1/2 initialize score (a double) or right/wrong counters
- +1 1/2 loop over either answers or key
 - +1/2 reference answers or key in loop body
 - +1/2 correctly access answers or key element in loop body
 - +1/2 access all answers or key elements
- +2 calculate score
 - +1/2 attempt to compare an answers element and a key element (== ok)
 - +1/2 correctly compare corresponding elements using equals
 - +1/2 add 1 to score if and only if equal
 - +1/2 subtract 1/4 from score if and only if not equal and answer not "?"
- +1/2 return calculated score

Part B:	highestScoringStudent	4 1/2 points
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- +1 1/2 loop over sheets
 - +1/2 reference sheets in loop body
 - +1/2 correctly access sheets element in context of loop
 - +1/2 access all elements of sheets
- +2 determine highest score
 - +1/2 get student score (call getScore(key) on a sheets element)
 - +1/2 compare student score with highest so far (in context of loop)
 - +1 correctly identify highest score (lose this if use constant for initial high)
- +1 return name
 - +1/2 access name (call getName on highest)
 - +1/2 return name

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Question 4: Game Design (Design)

Part A:	RandomPlayer	4 points
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```
+1/2 class RandomPlayer extends Player

+1  constructor
+1/2  public RandomPlayer(String aName)
+1/2  super(aName)

+2 1/2 getNextMove
+1/2  state.getCurrentMoves()
+1    if no moves
+1/2    test if size = 0
+1/2    return "no move" only if 0 moves
+1    if moves
+1/2    select random move index
+1/2    return random move
```

Part B:	play	5 points
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```
+1/2 print initial state (OK to print in loop)

+3  make repeated moves
+1    repeat until state.isGameOver()
+1/2  state.getCurrentPlayer()
+1/2  player.getNextMove(state)
+1/2  display player and move
+1/2  make move

+1 1/2 determine winner
+1/2  state.getWinner()
+1/2  display message if draw (if getWinner returns null)
+1/2  display message if winner
```

*lose both if done
before game ends*

**AP[®] COMPUTER SCIENCE A
2007 CANONICAL SOLUTIONS**

Question 1: Self Divisor

PART A:

```
public static boolean isSelfDivisor(int number) {
    int n = number;
    while (n > 0) {
        int digit = n % 10;
        if (digit == 0 || number % digit != 0) {
            return false;
        }
        n /= 10;
    }
    return true;
}
```

ALTERNATE SOLUTION:

```
public static boolean isSelfDivisor(int number) {
    String str = "" + number;
    for (int i = 0; i < str.length(); i++) {
        int digit = Integer.parseInt(str.substring(i,i+1));
        if (digit == 0 || number % digit != 0) {
            return false;
        }
    }
    return true;
}
```

PART B:

```
public static int[] firstNumSelfDivisors(int start, int num) {
    int[] selfs = new int[num];
    int numStored = 0;
    int nextNumber = start;
    while (numStored < num) {
        if (isSelfDivisor(nextNumber)) {
            selfs[numStored] = nextNumber;
            numStored++;
        }
        nextNumber++;
    }
    return selfs;
}
```

ALTERNATE SOLUTION:

```
public static int[] firstNumSelfDivisors(int start, int num) {
    int[] selfs = new int[num];
    int numStored = 0;
    int nextNumber = start;
    for (int i = 0; i < num; i++) {
        while (!isSelfDivisor(nextNumber)) {
            nextNumber++;
        }
        selfs[numStored] = nextNumber;
        numStored++;
        nextNumber++;
    }
    return selfs;
}
```

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2007 CANONICAL SOLUTIONS**

Question 2: Pounce Fish (MBS)

PART A:

```
private Fish findFish()
{
    Environment env = environment();
    Location loc = location();
    Direction dir = direction();

    for (int i = 0; i < range; i++) {
        loc = env.getNeighbor(loc, dir);
        if (!env.isEmpty(loc)) {
            return (Fish)env.objectAt(loc);
        }
    }
    return null;
}
```

PART B:

```
public void act()
{
    if (! isInEnv() )
        return;

    Fish prey = findFish();
    if (prey != null) {
        prey.die();           // OR environment().remove(pre);
        changeLocation(pre.location());
    }
    else {
        super.act();
    }
}
```

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Question 3: Answer Sheets

PART A:

```
public double getScore(ArrayList<String> key)
{
    double score = 0.0;
    for (int i = 0; i < answers.size(); i++) {
        if (answers.get(i).equals(key.get(i))) {
            score += 1.0;
        }
        else if (!answers.get(i).equals("?")) {
            score -= 0.25;
        }
    }
    return score;
}
```

PART B:

```
public String highestScoringStudent(ArrayList<String> key)
{
    StudentAnswerSheet highest = sheets.get(0);
    for (StudentAnswerSheet sheet : sheets) {
        if (sheet.getScore(key) > highest.getScore(key)) {
            highest = sheet;
        }
    }
    return highest.getName();
}
```

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Question 4: Game Design (Design)

PART A:

```
public class RandomPlayer extends Player
{
    public RandomPlayer(String aName)
    {
        super(aName);
    }

    public String getNextMove(GameState state)
    {
        ArrayList<String> possibleMoves = state.getCurrentMoves();
        if (possibleMoves.size() == 0) {
            return "no move";
        }
        else {
            int randomIndex = (int)(Math.random()*possibleMoves.size());
            return possibleMoves.get(randomIndex);
        }
    }
}
```

PART B:

```
public void play()
{
    System.out.println("Initial state:" + state);

    while (!state.isGameOver()) {
        Player currPlayer = state.getCurrentPlayer();
        String currMove = currPlayer.getNextMove(state);
        System.out.println(currPlayer.getName() + ": " + currMove);
        state.makeMove(currMove);
    }

    Player winner = state.getWinner();
    if (winner != null) {
        System.out.println(winner.getName() + " wins");
    }
    else {
        System.out.println("Game ends in a draw");
    }
}
```