CSE-202 – Practice Midterm Examination

Problem 1. (20 pts) What does the following program output when run?

```
#include <iostream>

int main()
{
  int *p;
  int q = 20;
  p = &q;
  int *r;
  cout << "p: " << *p << endl; //Answer p:_________________________
  r=p;
  cout << "r: " << *r << endl; //Answer r:_________________________
  *p= 2 * *p;
  cout << "q: " << q << endl; //Answer q:_________________________
  int s = *r + 2;
  cout << "s: " << s << endl; //Answer s:_________________________
}
```

Problem 2. (25 pts) Write a function **bitmap** that accepts a vector x of integers and an integer value y, and *returns a new vector* which replaces all values in x with either 0 or 1 depending on whether $x[i] < y$ or $x[i] \geq y$, respectively. (i.e. The returned vector contains 1 in position i if $x[i] \geq y$ and contains a 0 in position i otherwise - if $x[i] < y$.)

Imagine your function in the following context:

```
#include <iostream>
#include <vector>

int main()
{

  vector<int> nums;
  nums.pushback(9);
  nums.pushback(27);
  nums.pushback(14);
  nums.pushback(35);
  nums.pushback(16);

  vector<int> new_nums;

  new_nums = bitmap(nums, 25); // Calling bitmap

}

After calling bitmap in the above program, the value of the vector new_nums should be

  new_nums[0] = 0;
  new_nums[1] = 1;
  new_nums[2] = 0;
  new_nums[3] = 1;
  new_nums[4] = 0;
```

Problem 3. (25 pts total) A three-dimensional point consists of an x-coordinate value, y-coordinate value and a z-coordinate value. Give the member functions for the Point class below:

```
class Point
{
public:
  Point(); //creates the point (0,0)
  Point(int x, int y, int z); //creates the point (x,y)
  int getX(); //returns the x coordinate
  int getY(); //returns the y coordinate
  int getZ(); //returns the x coordinate
  void move(int dx, int dy, int dz); // moves the point (x,y,z) to (x+dx,y+dy,z+dz)

private:
  int xcoordinate;
  int ycoordinate;
  int zcoordinate;
};
```

Problem 4. (20 pts total) A polyhedron is a geometrical object having flat sides. A polyhedron can be defined by the vertices (corner points). Class Polyhedron is defined as follows

```
class Polyhedron
{
public:
  Polyhedron(); // empty polygon - no points
  Polyhedron(vector<Point> p); // polygon defined by vector p
  void move(int dx, int dy, int dz); // moves all the corners dx on x-axis, dy on y axis and dz o

private:
  vector<Point> corners;
};
```

Using the class Point from Problem 3, provide solutions to the following:

(a) Implement the constructor `Polyhedron(vector<Point> p)`.

(b) Implement the member function **move** which moves each corner of the polyhedron dx units on the x axis, dy units on the y axis and dz on the z-axis.

Problem 5. (10 pts total) Write an `int main()` function that creates a Polyhedron with points at (0,0,0), (2,0 0), (0,2,0), (2,2,0) and (1,1,2) and then moves the Ploy hedron 3 units in the x-direction, 5 units in the y-direction, and 10 units in the z-direction.

Bonus : What is the Polyhedron?