Question X: Graphics in Java [10]

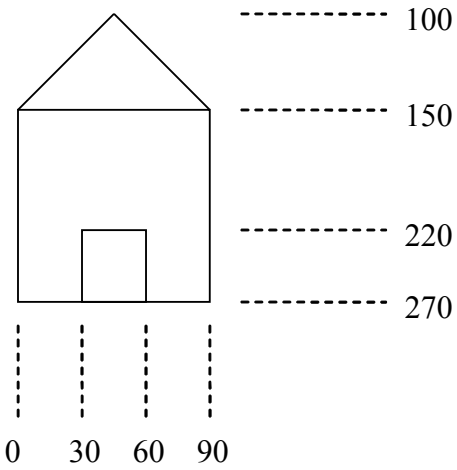
For the following questions, assume the Java2D graphics primitives:
Arc2D.Float (x, y, width, height, start, extent, type)
Ellipse2D.Float (x, y, width, height)
Line2D.Float (x1, y1, x2, y2)
Rectangle2D.Float (x, y, width, height)
RoundRectangle2D.Float (x, y, width, height, arcwidth, archeight)
Assume the API methods:
setColor (Color c)
draw (Shape s)
fill (Shape s)

1. Fill in the blanks in the following method to draw a square using only the primitive Line2D shape. [4]

```
void myDrawSquare ( Graphics2D canvas, float x, float y, float length )
{
  canvas.draw (new Line2D.Float (_____, _____, _____, _____ ));
  canvas.draw (new Line2D.Float (_____, _____, _____, _____ ));
  canvas.draw (new Line2D.Float (_____, _____, _____, _____ ));
  canvas.draw (new Line2D.Float (_____, _____, _____, _____ ));
}
```

```
void myDrawSquare ( Graphics2D canvas, float x, float y, float length )
{
  canvas.draw (new Line2D.Float ( x, y, x+length, y ));
  canvas.draw (new Line2D.Float ( x, y, x, y+length ));
  canvas.draw (new Line2D.Float ( x+length, y+length, x+length, y ));
  canvas.draw (new Line2D.Float ( x+length, y+length, x, y+length ));
}
```

2. Write a method to draw the following figure using a minimal number of line segments – i.e., lines must not overlap when drawn. Dimensions are indicated with dashed lines. [6]




```
void myDraw ( Graphics2D canvas )
{
  canvas.draw (new Rectangle2D.Float (0, 150, 90, 120));
  canvas.draw (new Line2D.Float (30, 270, 30, 220));
  canvas.draw (new Line2D.Float (30, 220, 60, 220));
  canvas.draw (new Line2D.Float (60, 220, 60, 270));
  canvas.draw (new Line2D.Float (0, 150, 45, 100));
  canvas.draw (new Line2D.Float (45, 100, 90, 150));
}
```

Question X+1: Number Systems [10]

Show all calculation for the following questions.

1. Convert 1001001.001_2 to decimal. [2]

$1001001.001 = 1*2^6 + 1*2^3 + 1*2^0 + 1*2^{-3}$
$= 64 + 8 + 1 + 0.125$
$= 73.125_{10}$

2. Convert 1001001.001_2 to octal. [1]

$1001001.001_2 = (001)(001)(001).(001)_2 = 111.1_8$ [1]

3. Use 4-bit 2's complement binary addition to calculate $7_{10} - 3_{10}$. [3]

$7_{10} - 3_{10}$
$= 0111 + 2comp(0011)$
$= 0111 + 1101$ [1]
$= 0100$ carry 1 – discard [1]
$= 4_{10}$ [1]

4. What test must be done to check for an overflow in the above calculation? [1]

If the numbers have the same sign and the answer has a different sign, then it is an overflow.

5. What is the value of the following number in IEEE 754 format? [3]

1 10000010 10000000000000000000000

sign = 1 so negative
biased exponent = $10000010 = 130_{10}$
actual exponent = $130 - 127 = 3$ [1]

significand = $.1_2$ = .5 [1]
*value: $(-1)^1$ * (1 + .5) * 2^3 = -1.5 * 8 = -12 [1]*

Question X+2: Boolean Algebra and Logic [5]

1. What Boolean operator corresponds to the following truth table? [1]

A	B	F
0	0	0
0	1	0
1	0	0
1	1	1

AND

2. Using a truth table, prove the identity: $A + B = \overline{\overline{A} \cdot \overline{B}}$ [4]

A	*B*	*^ A*	*^ B*	*A+ B*	*^A^ B*	*^(^A^B)*
0	*0*	*1*	*1*	*0*	*1*	*0*
0	*1*	*1*	*0*	*1*	*0*	*1*
1	*0*	*0*	*1*	*1*	*0*	*1*
1	*1*	*0*	*0*	*1*	*0*	*1*

[1 mark per line … it is not necessary to show every column as long as LHS/RHS are there]