

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)

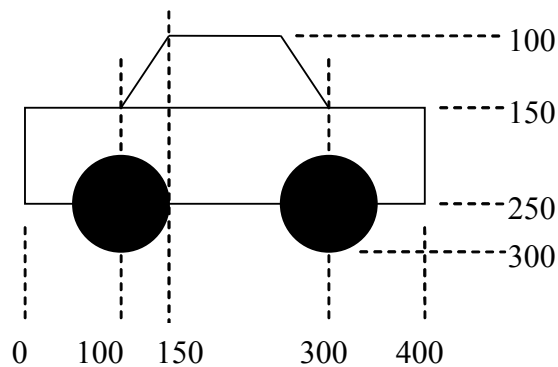
fill (Shape s)

1. Fill in the blanks in the following method to draw a rectangle without using the primitive Rectangle2D shape. [4]

```
void myDrawRectangle ( Graphics2D canvas, float x, float y, float w, float h )
{
    canvas.draw (new Line2D.Float ( _____, _____, _____, _____ ));
    canvas.draw (new Line2D.Float ( _____, _____, _____, _____ ));
    canvas.draw (new Line2D.Float ( _____, _____, _____, _____ ));
    canvas.draw (new Line2D.Float ( _____, _____, _____, _____ ));
}
```

```
void myDrawRectangle ( Graphics2D canvas, float x, float y, float w, float h )
{
    canvas.draw (new Line2D.Float ( x, y, x+w, y ));
    canvas.draw (new Line2D.Float ( x, y, x, y+h ));
    canvas.draw (new Line2D.Float ( x+w, y+h, x+w, y ));
    canvas.draw (new Line2D.Float ( x+w, y+h, x, y+h ));
}
```

2. Write a method to draw the following figure using the Java2D API. Dimensions are indicated with dashed lines. Where no dimensions are list, assume the figure is symmetrical. [6]



```
void myDraw ( Graphics2D canvas )
{
```

```

    canvas.draw (new Rectangle2D.Float (0, 150, 400, 100));
    canvas.draw (new Line2D.Float (100, 150, 150, 100));
    canvas.draw (new Line2D.Float (150, 100, 250, 100));
    canvas.draw (new Line2D.Float (250, 100, 300, 150));
    canvas.fill (new Ellipse2D.Float (50, 200, 100, 100));
    canvas.fill (new Ellipse2D.Float (250, 200, 100, 100));
}

```

Question X+1: Number Systems [10]

Show all calculation for the following questions.

1. Convert 120.75_{10} to radix 2. [2]

```

2 120
2 60 r 0
2 30 r 0
2 15 r 0
2 7 r 1
2 3 r 1
2 1 r 1
0 r 1 [1]
.75 * 2 = 1.50 intpart = 1
.5 * 2 = 1.0 intpart = 1 [1]
answer: 1111000.112

```

2. Convert 120.75_{10} to hexadecimal. [1]

$120.75_{10} = 1111000.11_{16} = (0111)(1000).(1100)_2 = 78.C_{16}$ [1]

3. Use 4-bit 1's complement binary addition to calculate $7_{10} - 3_{10}$. [3]

```

710 - 310
= 0111 + 1comp(0011)
= 0111 + 1100 [1]
= 0011 carry 1 - add [1]
= 0011 + 0001
= 0100
= 410 [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. Represent the floating point number 18.75_{10} in single-precision IEEE 754 format. [3]

```

sign is positive, so s=0
significand: 18.7510 = 10010.112 = 1.001011 x 24
actual exponent = 4
biased exponent = 4 + 127 = 131 = 100000112
answer: 0 10000011 001011000000000000000000

```

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	1
1	0	1
1	1	1

OR

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

A	B	\bar{B}	$B + \bar{B}$	$A(B + \bar{B})$
0	0	1	1	0
0	1	0	1	0
1	0	1	1	1
1	1	0	1	1

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