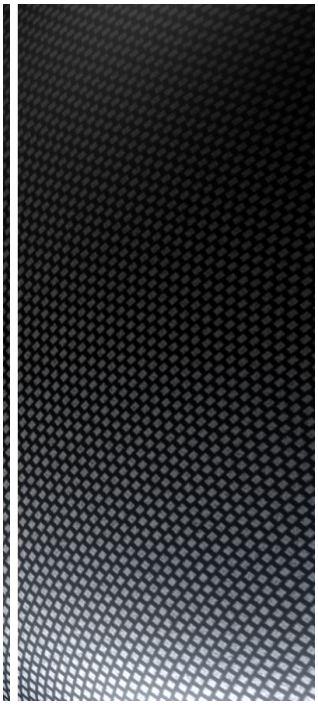
Automation (21-541)

Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session # 7

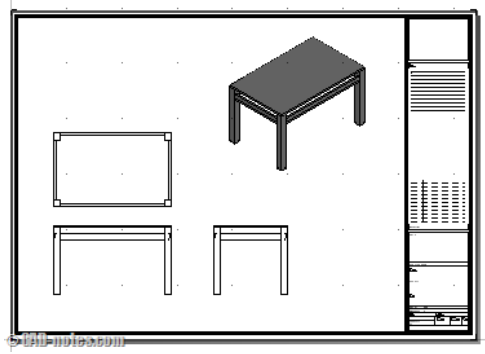


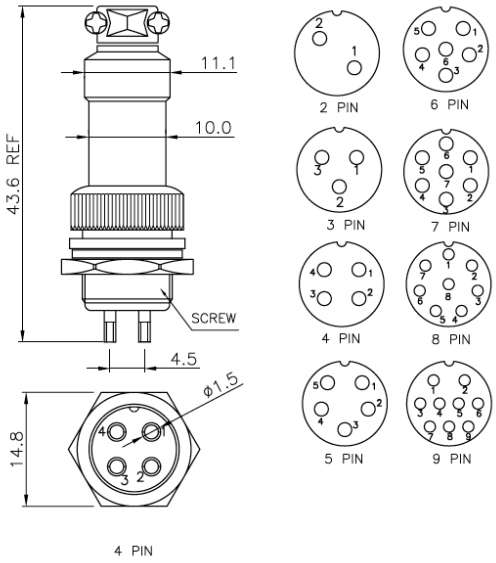
Session Schedule

- *Computer-Aided Design (CAD)*
  - *Introduction*
    - *Graphic primitives*

Computer-Aided Design (CAD)

- *Introduction:*
  - *Traditionally drawings are prepared on plane drawing sheets.*



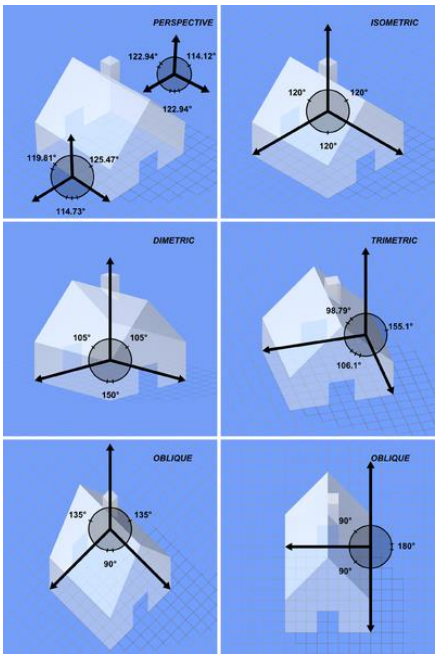


Computer-Aided Design (CAD)

- *Introduction:*
  - *Plane drawing sheets have several limitations:*
    - *The sketches have to be made only in two dimensions*
    - *Though the depth can be represented by*
      - *pictorial projections like:*

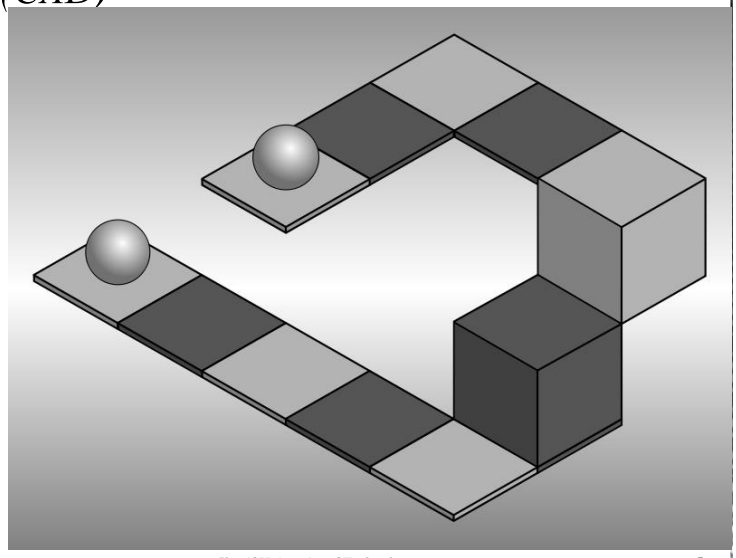
    isometric and perspective projections,

    the projections have to be necessarily reduced to two dimensions.



Computer-Aided Design (CAD)

- *Introduction:*
  - *Plane drawing sheets have several limitations:*



Computer-Aided Design (CAD)

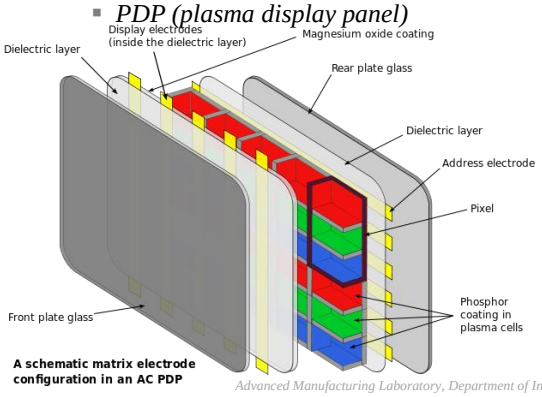
- *Introduction:*
  - *Use of computer graphics has opened up tremendous possibilities for the designer:*
    - *The object is represented by its geometric model in three dimensions (X, Y and Z)*
    - *The mathematical representation reduces creation of views like orthographic, isometric, axonometric or perspective projections into simple viewing transformations*
    - *Sections can be automatically created.*
    - *Revision and revision control are easy.*
    - *Drawings (geometric models) can be modified easily.*

Computer-Aided Design (CAD)

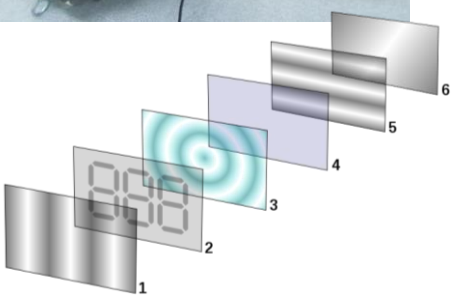
- *Graphic primitives:*
  - *Modern computer graphics displays consist of basically three components.*
    - *Monitor*
    - *Digital Memory or Frame Buffer*
    - *Display Controller*

Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *CRT (Cathode ray tube)*
  - *LCD (liquid crystal display)*
  - *PDP (plasma display panel)*

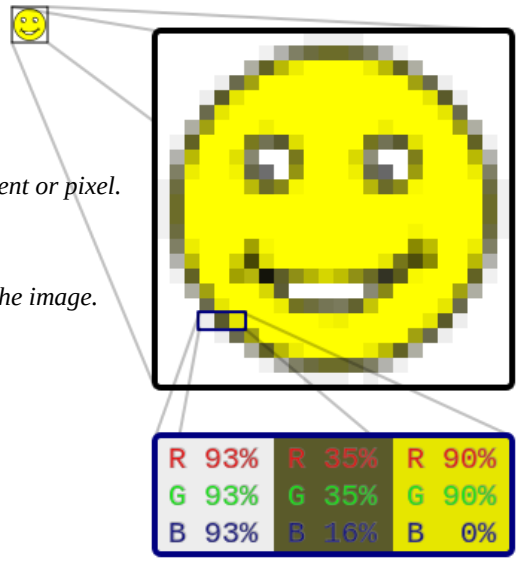


A schematic matrix electrode configuration in an AC PDP



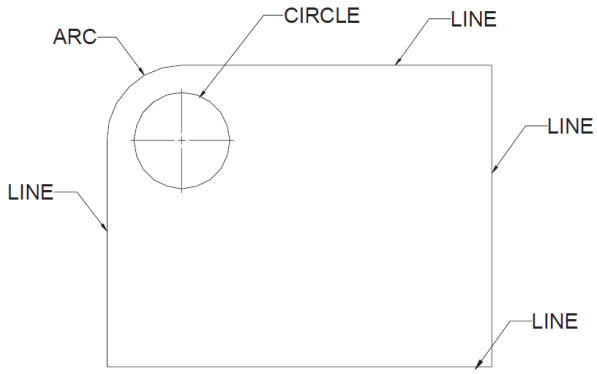
Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *The video display screen is divided into very small rectangular elements called a picture element or pixel.*
  - *Graphic images are formed by setting suitable intensity and color to the pixels which compose the image.*



Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *A drawing is created by an assembly of points, lines, arcs, circles.*
  - *The drawing entities that a user may find in a typical CAD package include :*
    - *point*
    - *line*
    - *construction line, multi-line, polyline*
    - *circle*
    - *spline*
    - *arc*
    - *ellipse*
    - *polygon*
    - *rectangle*



Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *Line*
  - *Straight line segments are used a great deal in computer generated pictures.*
  - *The following criteria have been stipulated for line drawing displays :*
    - *Lines should appear straight*
    - *Lines should terminate accurately*
    - *Lines should have constant density*
    - *Line density should be independent of length and angle*
    - *Line should be drawn rapidly*

Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *DDA algorithm (Digital Differential Analyzer)*
  - *The digital differential analyzer generates lines from their differential equations.*
  - *The DDA works on the principle that X and Y are simultaneously incremented by small steps proportional to the first derivatives of X and Y.*
  - *In the real world of limited precision displays, addressable pixels only must be generated.*

Computer-Aided Design (CAD)

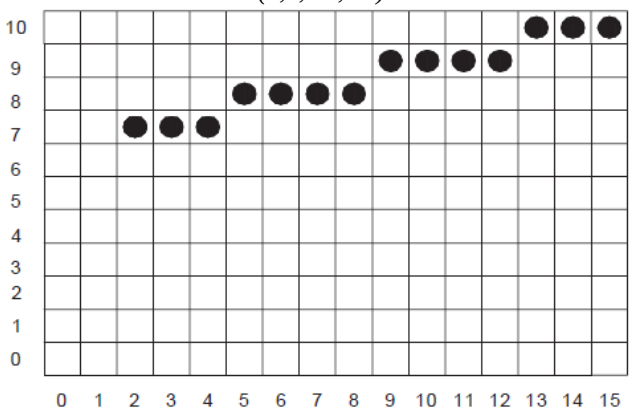
- *Graphic primitives:*
  - *Procedure DDA (x1, y1, x2, y2 : integer) ;*
  - *As begin:*
  - *STEP=max {abs(x2-x1), abs(y2-y1)}*
  - *Dx=(x2-x1)/STEP; Dy=(y2-y1)/STEP ;*
  - *X=x1; Y=y1;*
  - *For (int i=0; i<=STEP; i++)*

```
{
        plot(truncate(x),truncate(y));
        X= X+Dx+0.5;
        Y= Y+Dy+0.5;

}
```


Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *Procedure DDA (2,7, 15, 10)*



X	Y	trunc (X)	trunc (Y)
2.5	7.50	2	7
3.5	7.73	3	7
4.5	7.96	4	7
5.5	8.19	5	8
6.5	8.42	6	8
7.5	8.65	7	8
8.5	8.88	8	8
9.5	9.11	9	9
10.5	9.34	10	9
11.5	9.57	11	9
12.5	9.80	12	9
13.5	10.23	13	10
14.5	10.46	14	10
15.5	10.69	15	10

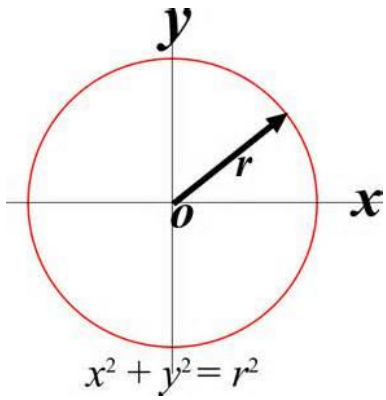
Homework # 4

- *Provide a simple program to plot geometric objects. You should use your CIM data base structure to maintain the geometric data.*
  - *A simple interface can be applied to plot the geometric objects.*
  - *You should provide your first module/procedure to plot a line by getting the required Cartesian locations in a 2D space.*

- *The HW should be sent to omidf@ie.sharif.edu till Saturday, 20th of Aban (Nov, 11th ,2013)*
- *Email subject: "HW4:GroupCode"*

Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *Procedure DDA (X1, Y1, R : integer) ;*



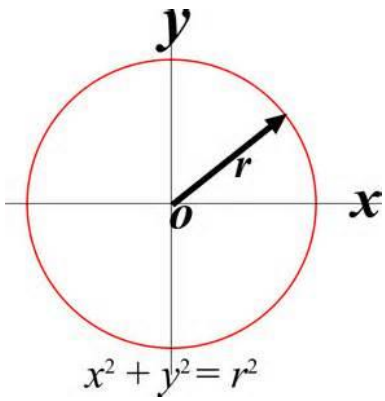
Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *Procedure DDA (X1, Y1, R : integer) ;*
  - *As begin*
  - *For(int tetha=0;tetha<360;thetha++)*

  {

  *Plot(X1+R*cos(theta),Y1+R*sin(theta))*

  }



Computer-Aided Design (CAD)

- *Graphic primitives:*
  - *Procedure DDA (X1, Y1, R : integer) ;*
  - *As begi*
  - *DTetha=1*
  - *For(int tetha= π;thetha+=Dtetha)*

  {

  *Plot(X1 os( ),Y1+R*sin(theta))*

  }