



NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR

HAZRATBAL, SRINAGAR- 190006 (J&K)

VISION OF THE INSTITUTION

To establish a unique identity of a pioneer technical Institute by developing a high-quality technical manpower and technological resources that aim at economic and social development of the nation as a whole and the region, in particular, keeping in view the global challenges.

MISSION OF THE INSTITUTION

- M1.** To create a strong and transformative technical educational environment in which fresh ideas, moral principles, research and excellence nurture with international standards.
- M2.** To prepare technically educated and broadly talented engineers, future innovators and entrepreneurs, graduates with understanding of the needs and problems of the industry, the society, the state and the nation.
- M3.** To inculcate the highest degree of confidence, professionalism, academic excellence and engineering ethics in budding engineers.



NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR

HAZRATBAL, SRINAGAR- 190006 (J&K)

DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE DEPARTMENT

To create a unique identity of the Department by achieving excellent standards of quality technical education keeping pace with the rapidly changing technologies and to produce Civil Engineers of global standards with the capability of accepting new challenges.

MISSION OF THE DEPARTMENT

- M1. To promote academic growth in the field of Civil Engineering by offering state-of-the art undergraduate and postgraduate programmes.
- M2. To provide knowledge base and consultancy services in all areas of Civil Engineering for industry and societal needs.
- M3. To inculcate higher moral and ethical values among the students to become competent Civil Engineers with overall leadership qualities.
- M4. To flourish as the Centre of Excellence in the emerging areas of research related to Civil Engineering and its allied fields.

NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR

Name of Department: **Department of Civil Engineering**

- | | | |
|--|---|------------------------------|
| 1. Subject Code: CIV-705 | 2. Course Title: Computer Aided design (CAD) | |
| 3. Relative Weightage: Minor: 30; CA: 10; Major: 60 | 4. Contact Hours: L: 1 T: 1 P: 3 | |
| 5. Credits: 03 | 6. Semester: Autumn | 7. Pre-requisite: Nil |

8. Objective: **To introduce students to various application software(s) related to Civil Engineering so that they can find the applicability of one (or more) in their project work.**

Details of the Course:

Introduction: Introduction to hardware, software, storage devices and operating systems; Difference and link between system software and application software; Historical development of computer languages; Previous interfaces and Graphical User Interface (GUI); Binary system; file types and various extensions; Classification of the software(s).

AutoCAD: Introduction to AutoCAD 2017 user interface; Templates; basic commands; Tabs, panels and ribbons; Edit/Modify Objects commands; View Objects commands; Selection methods; Accuracy in drafting; Grips; units; Snap and Grid; Inquiry commands; understanding layers and their attributes; linetypes; Match Properties; Text and Mtext; Hatch fundamentals; Gap tolerance; Gradients and solid fills; Dimensions; Creating and working with blocks and wblocks; Purge; Creating a polar array, rectangular array and path array; Printing and Plotting in AutoCAD; Isometry in Auto CAD.

Surfer and SPSS: Introduction to Surfer; working in plots and worksheets; tabs in surfer- file, edit, draw, grid etc.; customizable maps- base maps, contour maps, wireframes, etc.; working with graphs; exporting and importing files to other softwares. Introduction to SPSS; working with data view; working with variable view; analysis of the data- mean comparison, correlate, regression; chart builder.

MATLAB: Introduction to MATLAB; its uses and application in Civil Engg.; introduction to workspace and command window, machine learning; data normalization in MATLAB; constructing a network, training the network, simulation, post-training analysis and validation.

LECTURES-Main Points/ Headings

VIEWING TOOLS

1. Zoom
2. Regen
3. Pan

SELECTION METHODS

4. Crossing - green
5. Window – blue
6. Lasso function – crossing and window

DRAWING AIDS AND ACCURACY

1. ORTHO (F8)
2. OSNAP

GRIPS

UNITS- using architectural system

SNAP AND GRID

Dynamic input mode- automatically tells us the details about distance and angles

Use of tab key in DYNMODE

Manual mode- (x,y) and @length<angle

Difference between the Dynamic Mode and Manual Mode

Inquiry Commands

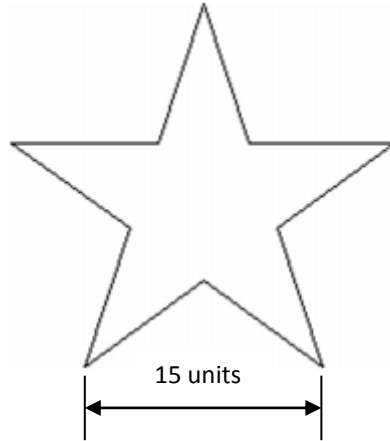
- Area
- Distance
- List-info about the object
- ID- point location
- Radius
- Angle

More Drafting Commands

Explode Time join

Exercises

1. Draw a STAR (T)



2. Draw a three legged intersection (T) with following details: (T)

Road A= 15m width (divider/median=3m)

RoadB= 7m

Make conflict point diagram

Show cross conflicts by red circles

Diverging conflicts by blue rectangles

Merging conflicts by yellow triangles

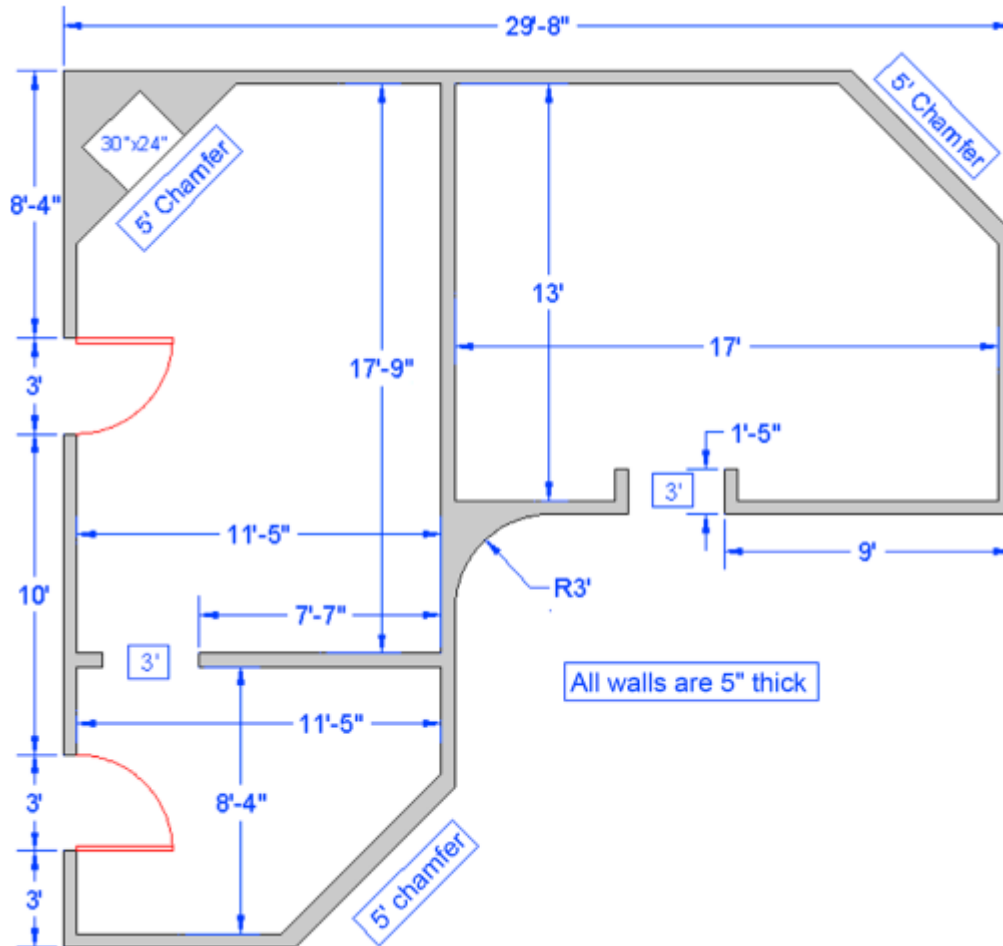
The connection should not be sharp

LECTURE

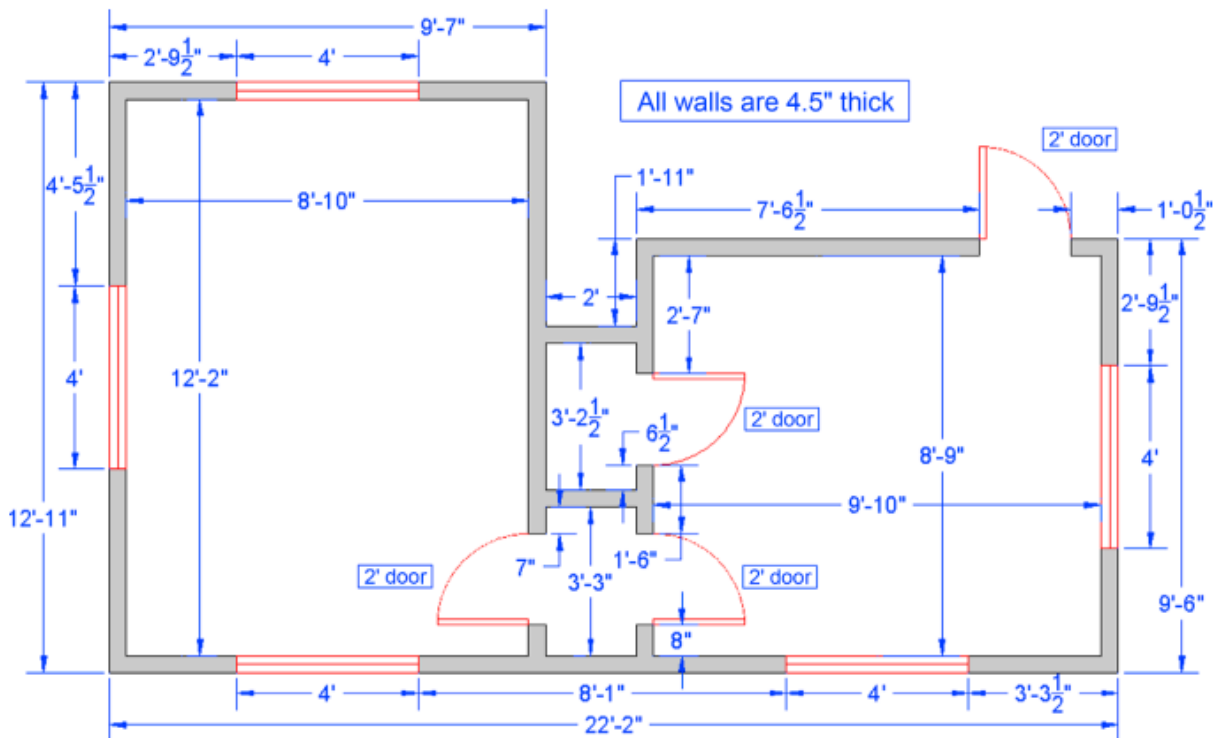
1. Layers: why layers? creating new layers; setting attributes;
Freeze/ thaw; on/off; lock/unlock; using layer toolbar
2. Use of LW command
3. Use of LINETYPE
4. Use of LTSCALE
5. Introduction to Properties, Quick Properties and Match
Properties

Practice drawings/ Assignments

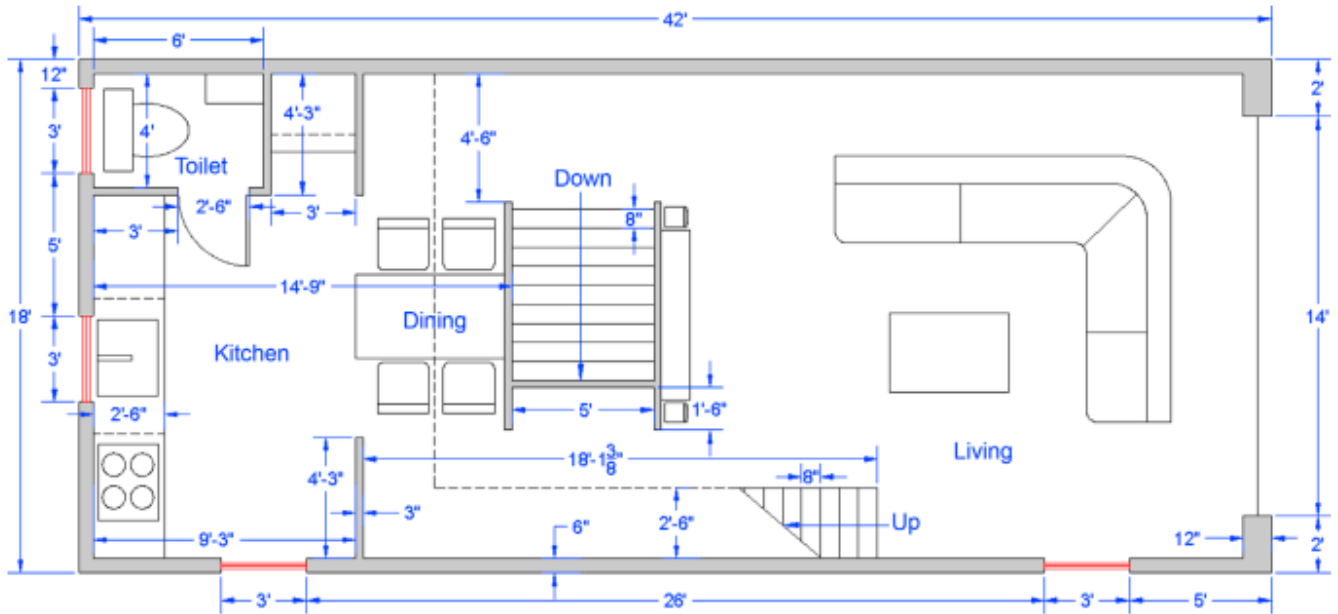
Q: Assignment for students with their roll numbers as prime number. (T)



Q: Assignment for students with their roll numbers as even numbers but not prime.(A)



Q: Assignment for students with their roll numbers as odd numbers but not prime.(A)



LECTURE

Working with:

1. SKETCH
2. ARC TEXT

Class Assignment: (T)

Q: Draw the following logo in AutoCAD 2017 with precision (T)



Assignment: (A)

Q: Design a logo for Civil Engg. Dept. (NIT Srinagar) using AutoCAD 2017.

LECTURE

TEXT:

- **TEXTEDIT/ DDEDIT**
- **%%p, %%u, %%c, %%d** (use in the prefix)
- **Text is used mostly when only one or a few lines are needed.**
- **The text cannot be formatted nor any effects added, beyond underlining and a few other minor effects.**
- **Multiple lines of text are not in paragraph form, rather they remain individual lines.**

MTEXT

- **MTEXTEDIT**
- **MText edit toolbar and Character map**

- **Used primarily for writing paragraphs.**
- **Has extensive formatting and editing features.**
- **Has an extensive symbol library and spell check.**
- **Can accept extensive text importing.**

Use of NEAREST OSNAP – a misnomer

Class (T)

Q: Make a professional title box for your drawing using TEXT and MTEXT commands and analyse the difference between the two.

Q: Make a legend/ symbol box with description showing 20 different symbols used in Civil Engineering discipline.(T)

LECTURE

Working with HATCH

Step 1. Pick the hatch pattern you want to use.

Step 2. Indicate where you want the pattern to go.

Step 3. Fine-tune the pattern by adjusting scale and angle (if required).

Step 4. Preview the pattern and accept it if OK.

HATCHEDIT

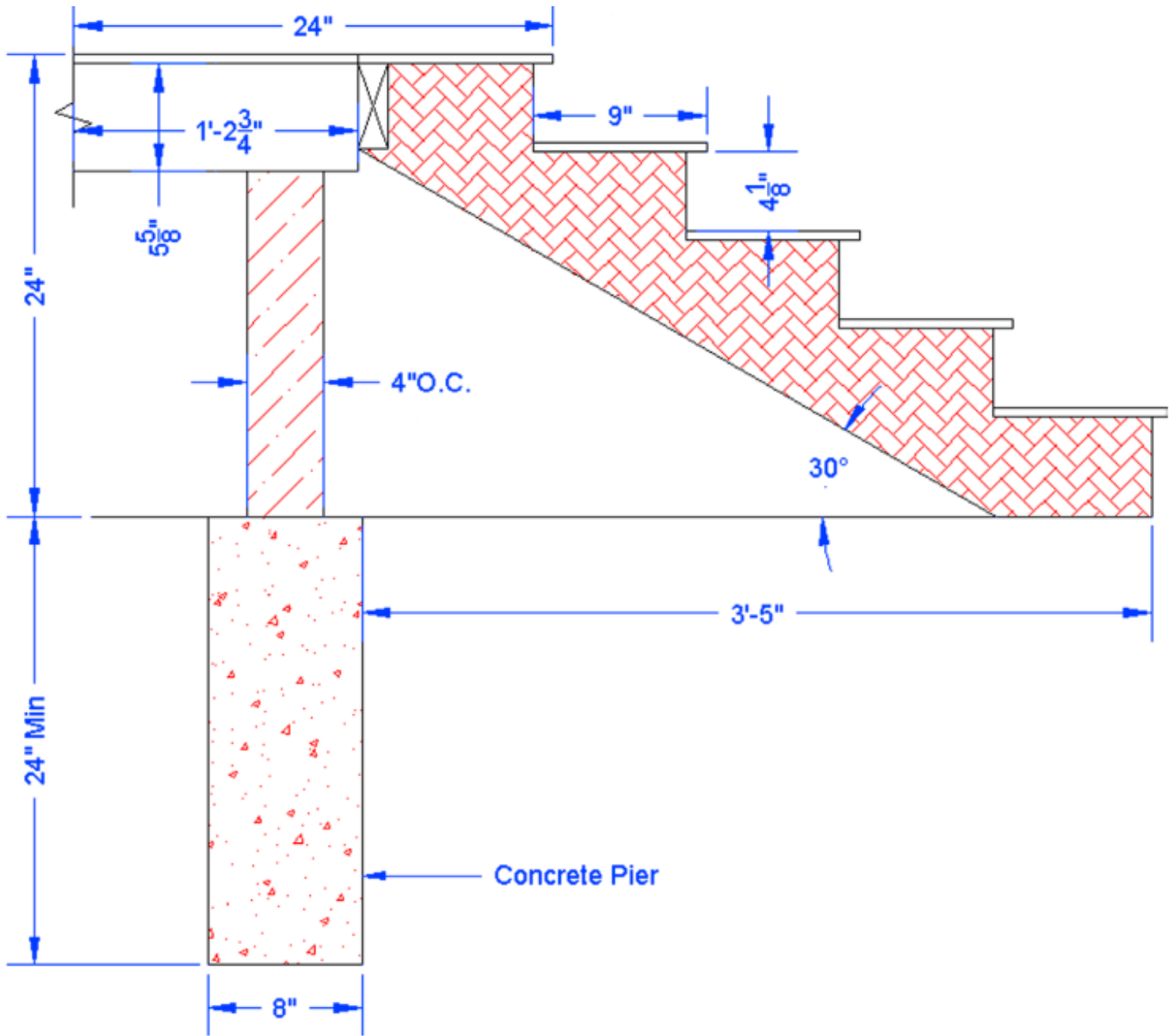
Why Associative? Give examples with and without associative option.

GAP TOLERANCE values in Hatch Edit Options

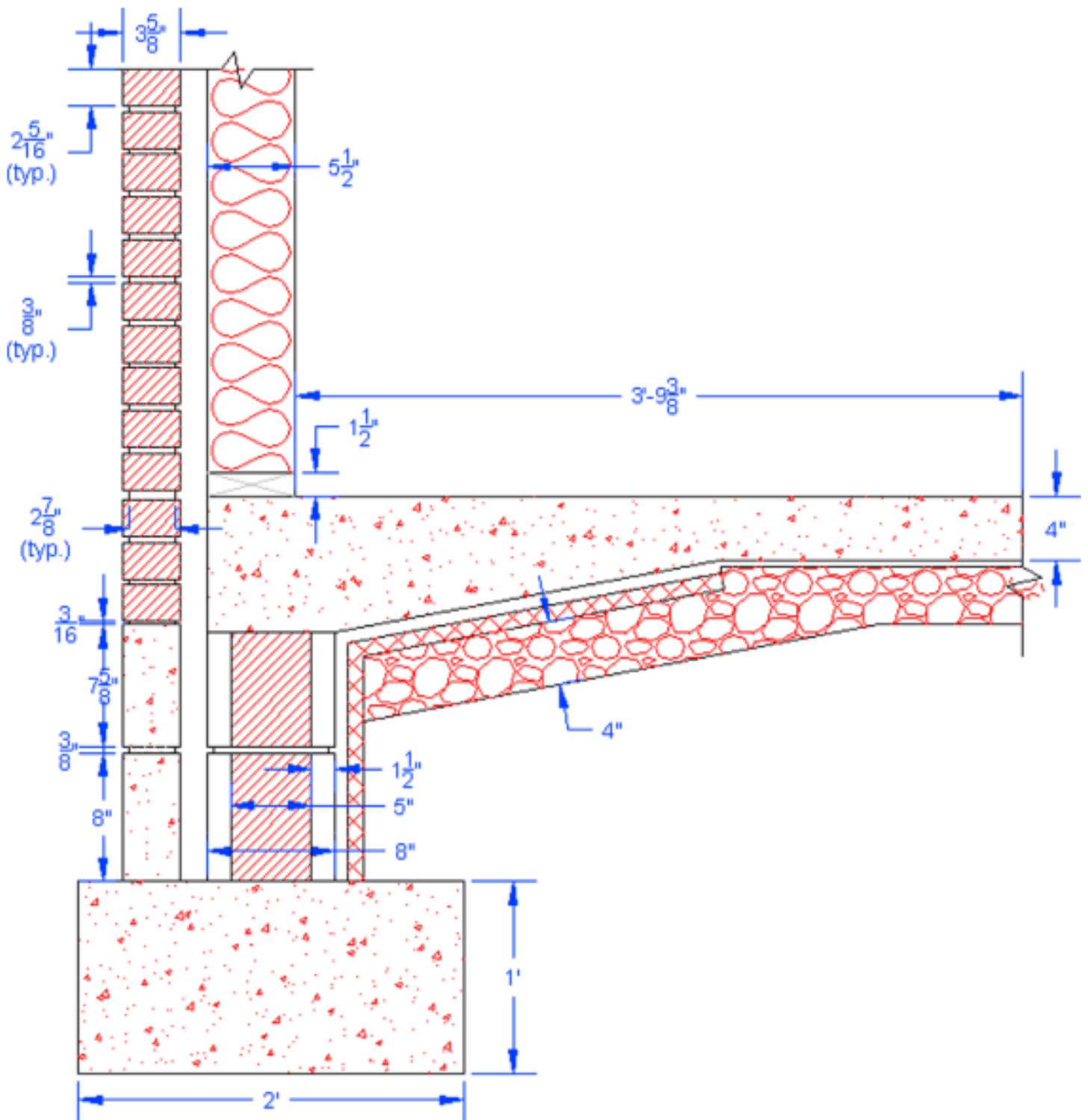
GRADIENT

BOUNDARY

Q: For even consoles.(A2)



Q: For odd consoles.(A2)



LECTURE

Working with Dimensions

Primary dimensions are the dimensions used most often by the typical architectural or engineering designer:

- Linear (horizontal and vertical)
- Aligned
- Diameter
- Radius
- Angular
- Continuous
- Baseline
- Leader

Commands: DIM, QDIM, DIMCONTINUE, DIMBASELINE

MULTILEADER,

MLEADERSTYLE > modify> content> multileader type> block

Other functions overview

Secondary dimensions are: (Give examples)

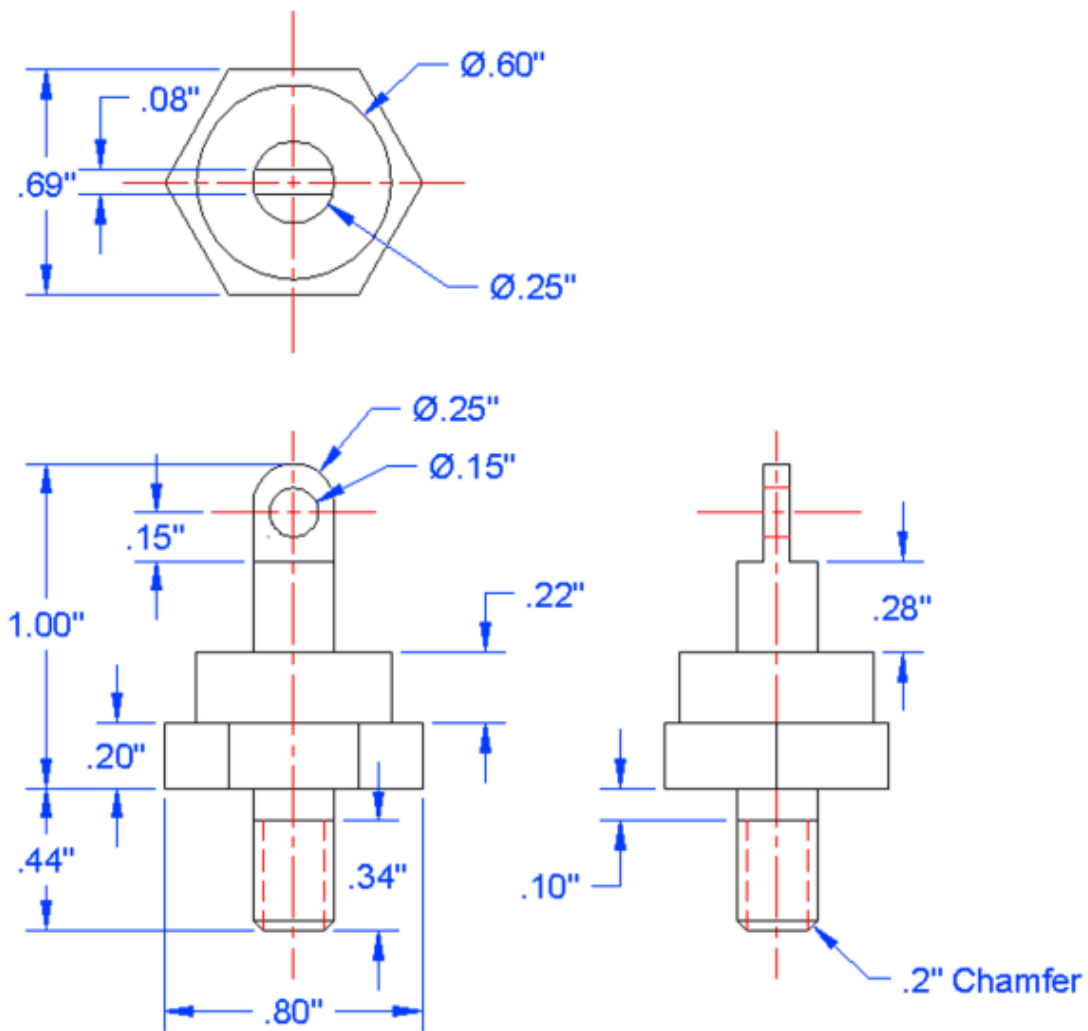
- Arc length
- Jogged
- Jogged linear
- Ordinate

Editing dimensions

DIMSTYLE, DDEDIT

Center Marks and CenterLines: CENTERMARKEXE, CENTERLTYPE, CENTERLAYER, and CENTERLTSCALE

Q: Class Tutorial



LECTURE

BLOCK is a collection of objects that are grouped and held together under some identifying name.

Concept: 1. Reuse

2. Symbol libraries

Working with BLOCKS: (Command: “BLOCK”)

- **Creating a Block**
- **Inserting a Block (Command: “INSERT”)**

Purge- to clean up permanently

(Command: “PURGE”)

OR

File> Drawing Utilities> Purge

Two main points to remember are:

- Purge does not get rid of objects that are visible and present in the drawing - it is not an erase command.
- Purge is permanent (unless you immediately undo it), so be careful of what you purge. If you anticipate eventually needing something, do not purge it out.

Write Blocks – the only exception is that it is stored externally into the file

(Command: “WBLOCK”)

INSERT > Browse

Dynamic Blocks: Three things make up a dynamic block:

1. Geometry
2. Parameter (at least one)- defines features

3. Action associated with that parameter (at least one)- defines modification

Block Editor(Command:BEDIT)

Visibility in blocks (multiple visibilities) - give examples by making different geometric shapes and change their visibility states

Parameter> Visibility> Visibility state (Ribbon)> Rename and add all the shapes> Drop down menu (active state)> make all other invisible
(Command: “BVHIDE”)

Working with GROUPS

- **Quick properties in GROUPS**
- **Group Selection ON/ OFF**

OR

(Command: “PICKSTYLE”)

- **Ungroup:(Command: “UNGROUP”)**
- **Group edit:(Command: “GROUPEdit”): Add/ Remove/ Rename Group**
- **Group Manager:(Command: “CLASSICGROUP”)**

Assignment

Q: Draw 20 different blocks which are required time and again in Civil Engineering drawings. Try out all the three options and analyse the difference between the three.

Q: What are the various merits and demerits of GroupsoverBlocks?

LECTURE

ARRAYS

Definition: Arrays are very useful tools in AutoCAD to create patterns of objects.

Types of Arrays: 1. Polar Array

2. Rectangular Array

3. Path Array

POLAR ARRAY:

A polar array is a collection of objects around some common point arranged in a circle (or part thereof).

Four critical items required to create a polar array:

1. What object(s) to array
2. The centre point of the array
3. How many objects to create (six, seven or ten)
4. If the pattern goes all the way around (i.e., is it 360° or less)

Creating a Polar Array

Command: “**ARRAYPOLAR**”

Grips in Array

Items, Rows, Levels, Properties and Options/ Close Array

(Explain each function with examples)

Command: “**ARRAYCLASSIC**”- feel of older AutoCAD versions

(Create an array using classic mode)

RECTANGULAR ARRAY

A rectangular array replicate objects in rows (horizontal) and columns (vertical).

Three critical items required to create arectangular array:

1. What object(s) to array
2. How many rows and columns to create
3. Distance between the rows and the columns

Creating arectangular array

Command: “**ARRAYREC**”

Columns, Rows, Levels, Properties and Options/ Close Array

Command: “**ARRAYCLASSIC**”- feel of older AutoCAD versions

(Create an array using classic mode)

PATH ARRAY

A path array creates a pattern along any predetermined pathway, of any shape, as opposed to a strictlycircular or linear one.

Three critical items required to create a path array:

1. What object(s)to array
2. The path
3. How many objects to create

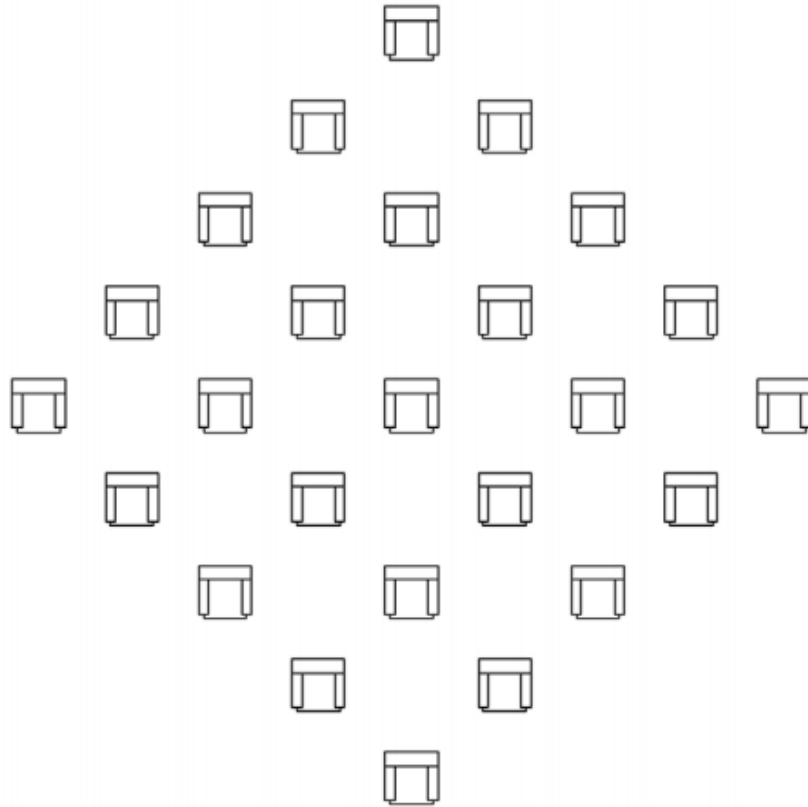
Creating a Path Array

Command: “**ARRAYPATH**”

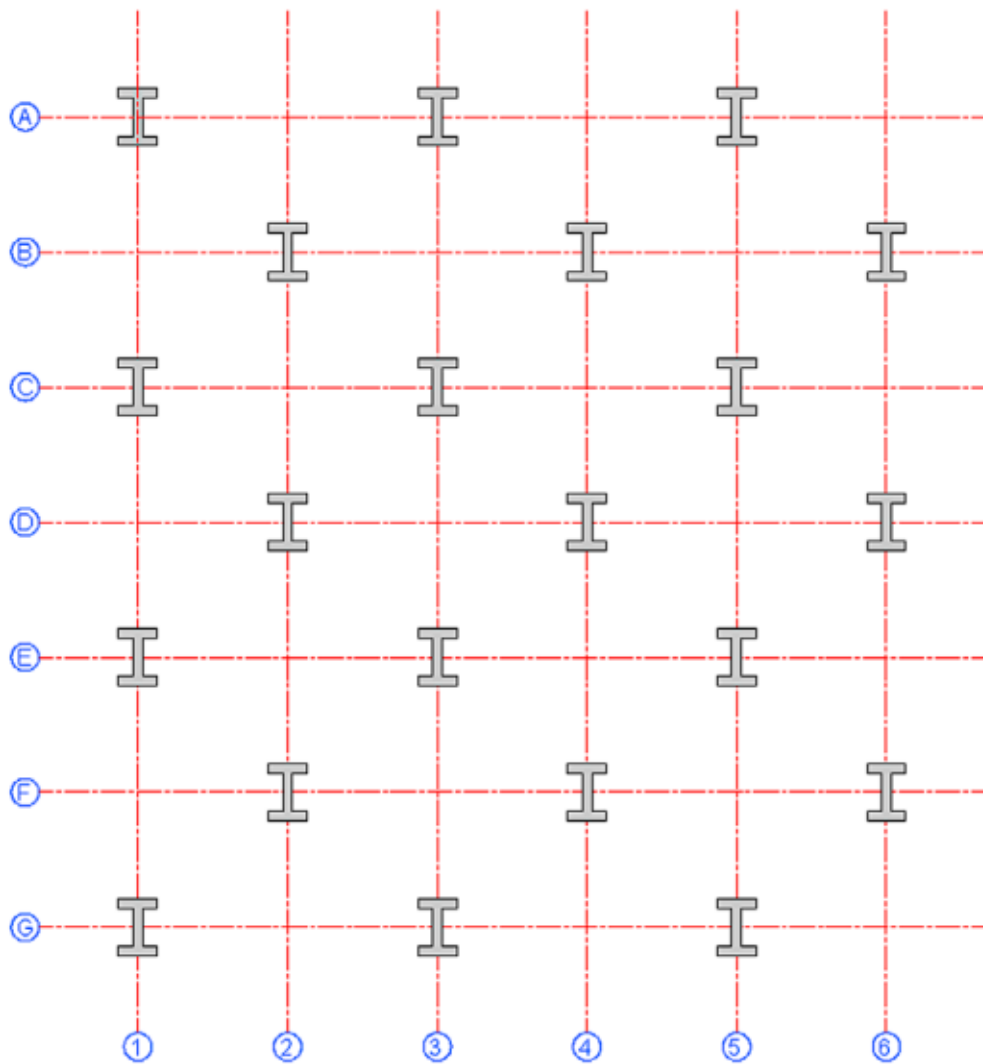
Items, Rows, Levels, Properties and Options/ Close Array

Practice drawings

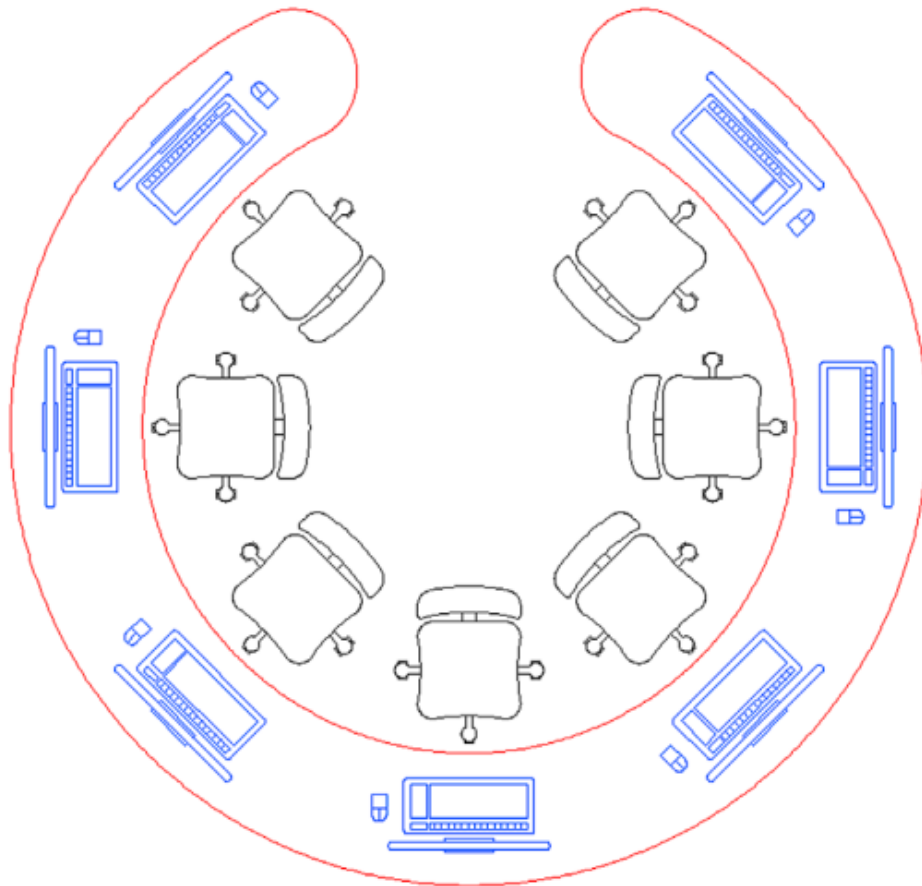
Q1: Draw the following five row by five column rectangular array. The chairs are 20" by 20" and the offset between them is 50". The array is also at a 45° angle.



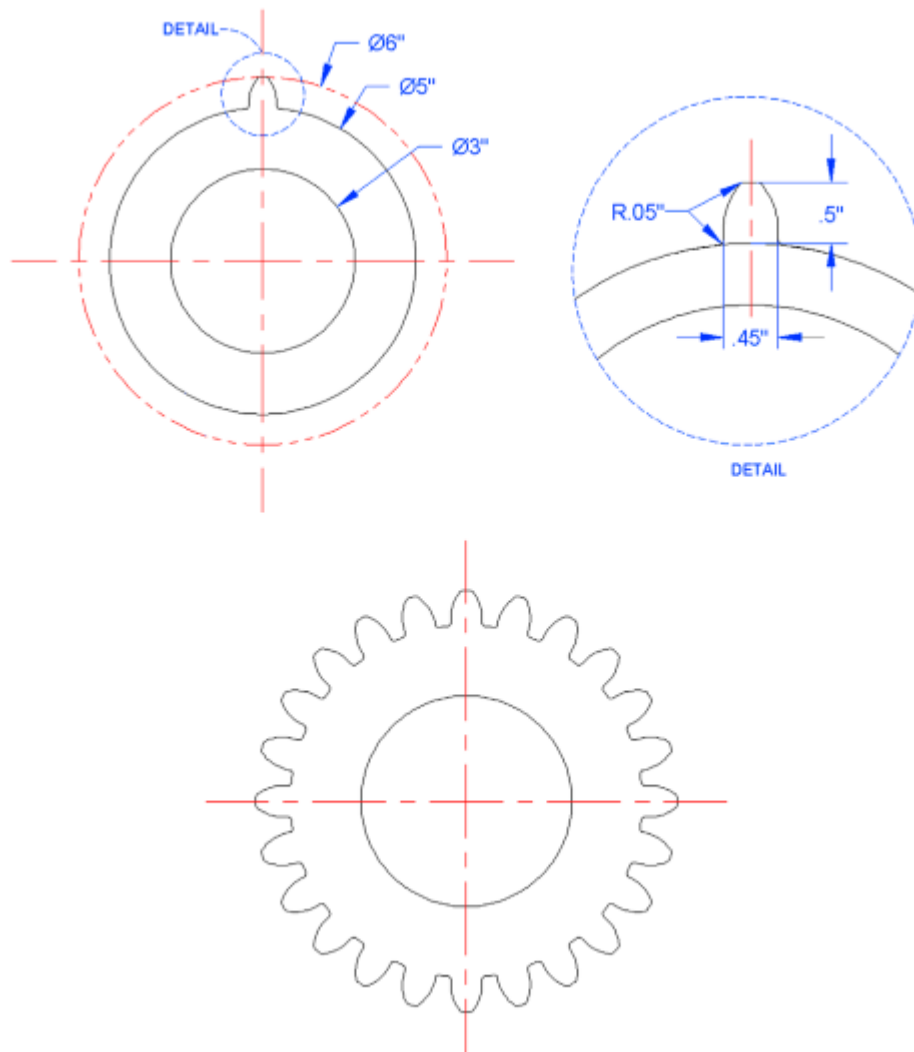
Q2: Draw the following seven rows by six column rectangular array, including the centerline grid and the grid lettering and numbering. The I-beams and the offset between them can be of any appropriate size, but approximate everything to look like the image shown.



Q3: In a new file, draw the following polar array, made up of a table, chairs, and computers. No sizing is given and all elements can be approximated. Place each element on the appropriate layer, and make a block out of it prior to using it in the array.



Q4: In a new file, draw the following gear array. Begin with circles of the indicated diameter. Then, focus on creating the first tooth, as seen in the detail. Make sure it is centered and aligned. Finally, array the tooth (24 teeth are used in the example) and clean up the design with trimming. The final result follows.



LECTURE

PRINTING AND PLOTTING AUTOCAD DRAWINGS

➤ ESSENTIALS FOR PRINTING OR PLOTTING:

1. What printer or plotter to use?
2. What paper size to use?
3. What area to plot?
4. At what scale to plot?
5. What pen settings to use?
6. What orientation to use?
7. What offset (if any) to use?

1. What printer or plotter to use?

Printer or plotter (depends on number of factors)

2. Some basic sized papers:

- A size: 11" × 8.5" sheet of paper (letter).
- B size: 17" × 11" sheet of paper (ledger).
- C size: 22" × 17" sheet of paper.
- D size: 36" × 24" sheet of paper.
- E size: 48" × 36" sheet of paper.

➤ Difference between printing and plotting

Printing usually refers to the output of drawings on A- or B-sized paper, which is easily done on most office LaserJet printers. *Plotting* usually refers to output of drawings on C-, D-, or E-sized paper, which has to be done on plotters.

3. What Area to Plot?

Extents: Prints what AutoCAD sees (not necessarily what you see)

Tip: Use zoom> extents

Be aware: Freeze, Defpoints, etc. (layers)

Window

Display

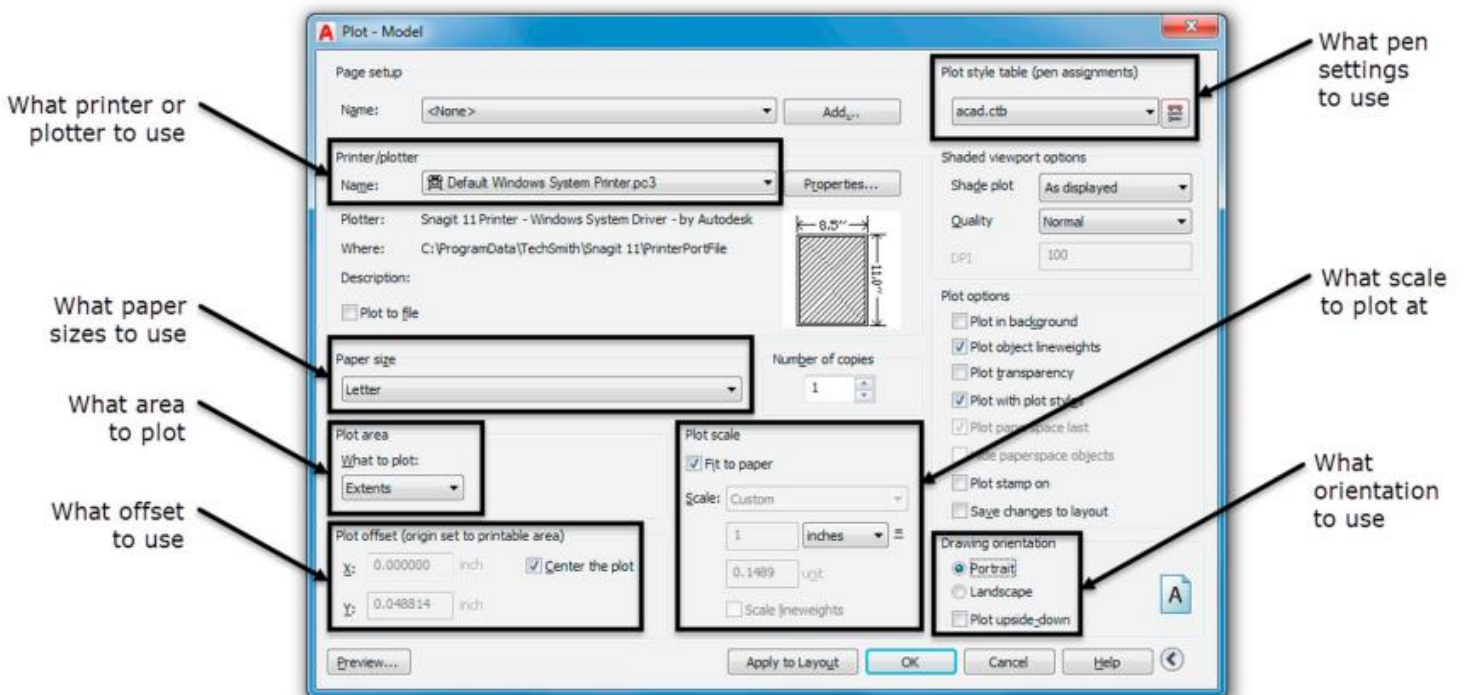
Limits

4. At what scale to plot?

5. What pen settings to use?(Pencils- 2H, 4H, etc.) ~ professional look

6. What orientation to use?(portrait or landscape)

7. What offset (if any) to use?(x=? and y=? OR Center the plot)



- **Importance of option “Preview”**
- **PAGE SETUP MANAGER**

Output tab (ribbon)> Page setup manager

Create a new setup. Merits of using “import”.

(Give examples to illustrate by switching between the drawings)

Class Assignment:

Q: Draw margins and a title box in the layout tab. The drawing (e.g. a floor plan) should be made in model tab. Then try out different options available under “Plot”.

(try to give a demo)

LECTURE

ISOMETRIC DRAWING IN AUTOCAD

Definition: Isometric perspective means representing a three-dimensional object in two dimensions.

Q: What is the difference between **Isometric** and **Axonometric** drawings?

Assignment Question:

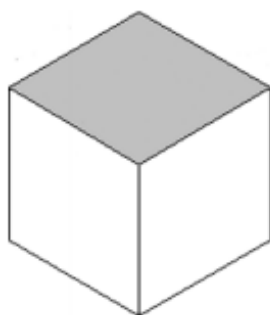
Q: When **to** use isometry over 3D drawing?

Q: When **not to** use isometry over 3D drawing?

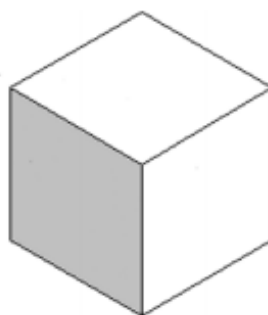
➤ **Basic Concept of Isometry**

Rule of 30° - 60° - 90°

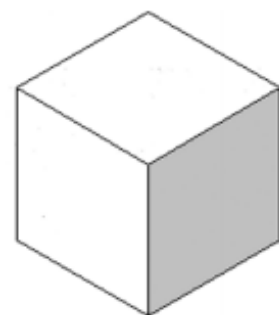
Tip 1: Switching between the planes- **F5 key**



TOP PLANE



LEFT PLANE




RIGHT PLANE

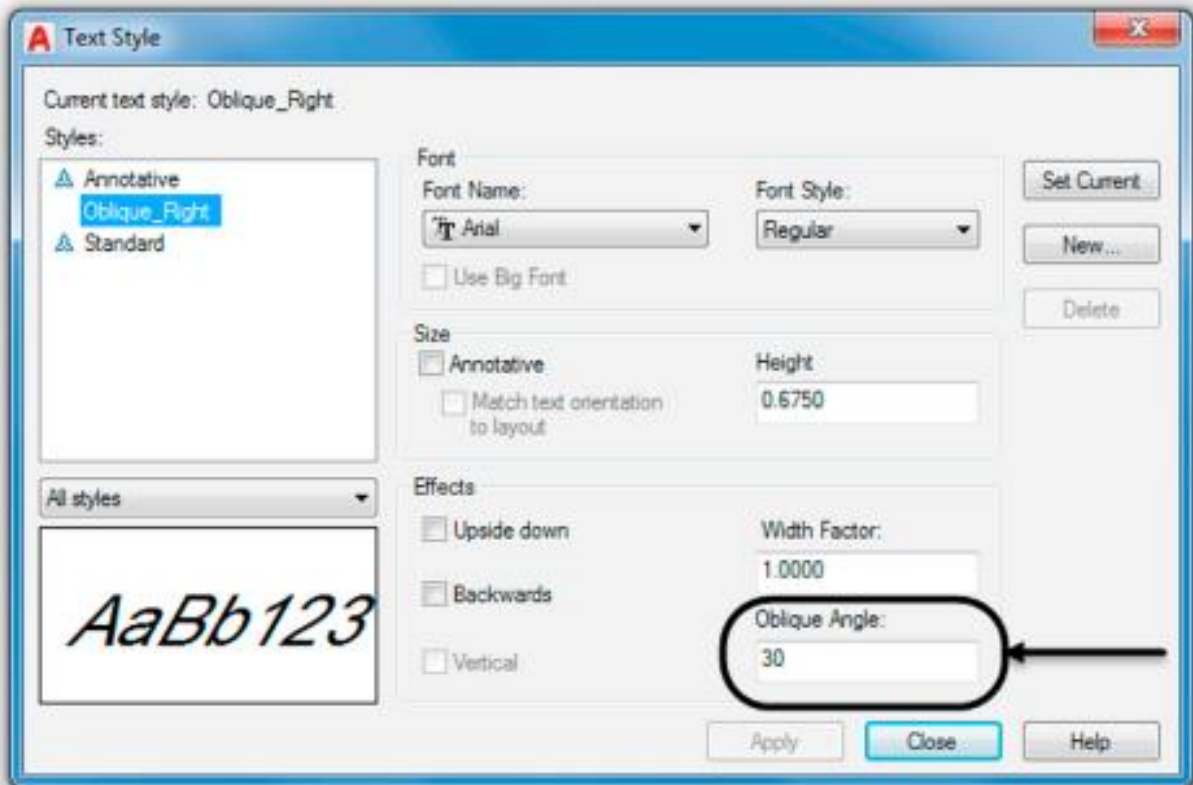
Tip 2: Set your **cursor to 100%** for better visualisation of planes.

Tip 3: Have **ORTHO on** always when using isometry.

Tools> Drafting Settings> Snap and Grid Tab> Isometric Snap

- **Ellipse for circles**
- **Text:**

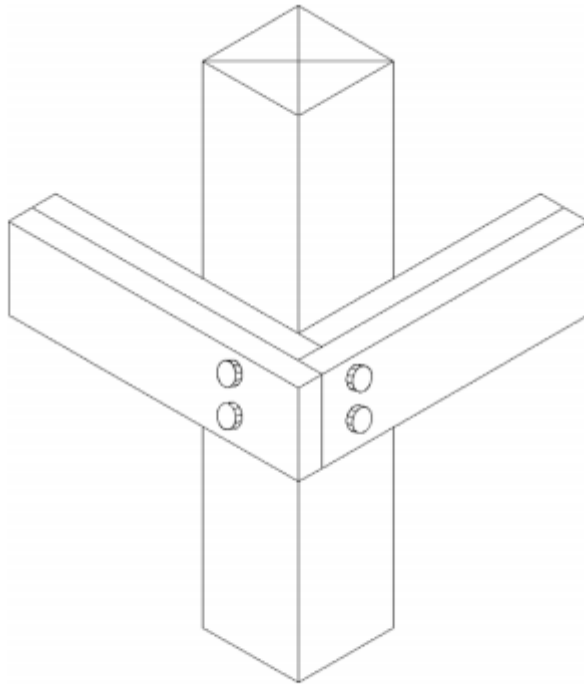
Tip: Format> Text Style(if Cascading Menu is hidden go to  in the top left and click on show menu bar)

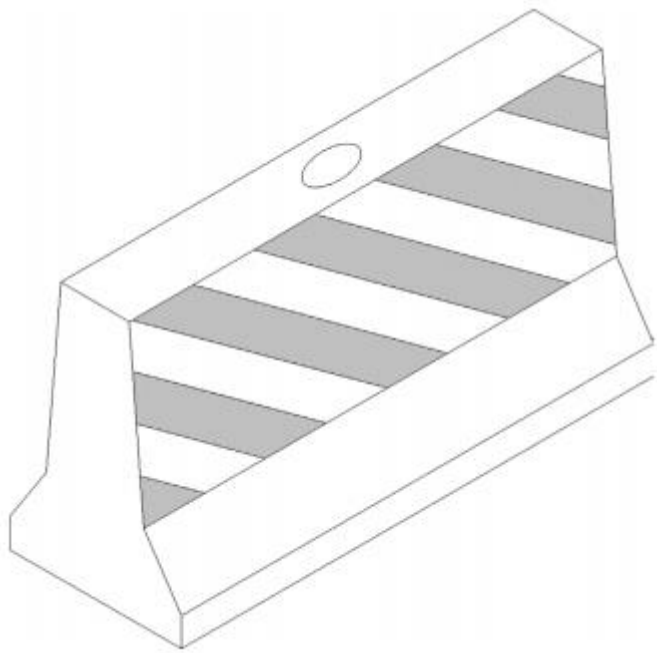
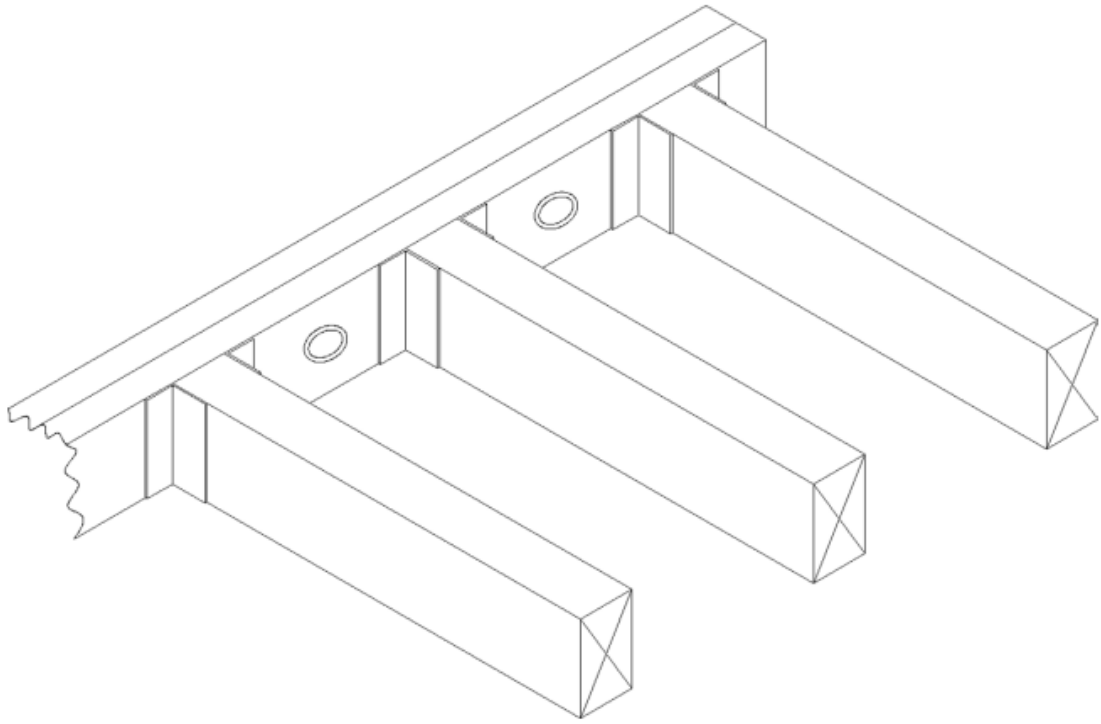


Use negative 30 for other plane. Make sure you rotate the text 30° and 330° respectively.

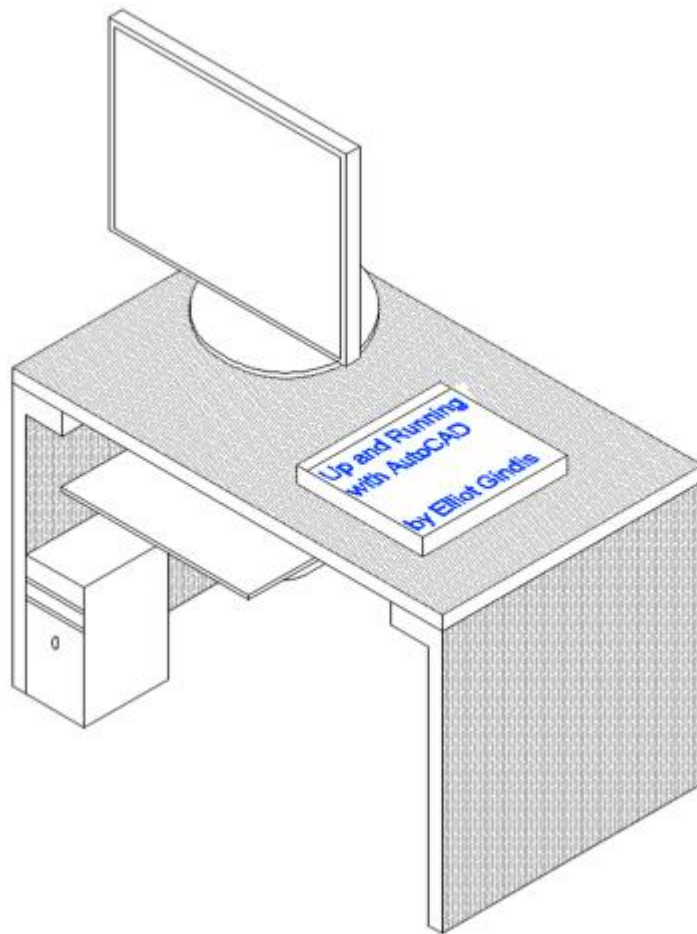
Assignments

Q: Try the following isometric drawings in AutoCAD. Estimate the dimensions but make sure it looks alike the drawings shown.





Q: Draw the computer table that you are using in CAD Lab along with all the accessories (monitor, CPU, notebook, etc.)



LECTURE

3D BASICS IN AUTOCAD

➤ Concepts:

Axes, Planes and Faces

➤ 3D Workspaces, Ribbon, Toolbars, and 3DOptions

Choose 3D Modeling from drop-down menu (*currently set as Drafting and Annotation*)

[For now] using **Tools**→**Toolbars**→**AutoCAD** in the cascading menus, bring up the following toolbars:

View

3D Navigation

Visual Styles

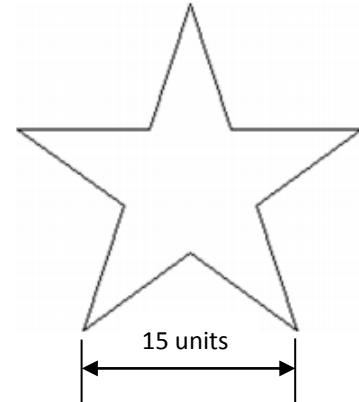
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
Department of Civil Engineering

Subject Code: CIV-705

Course Title: Computer Aided design (CAD)

Tutorial 1

1. Draw a perfect five-sided star shown below using basic commands in AutoCAD.



2. Draw a three legged (T) intersection with the following details:

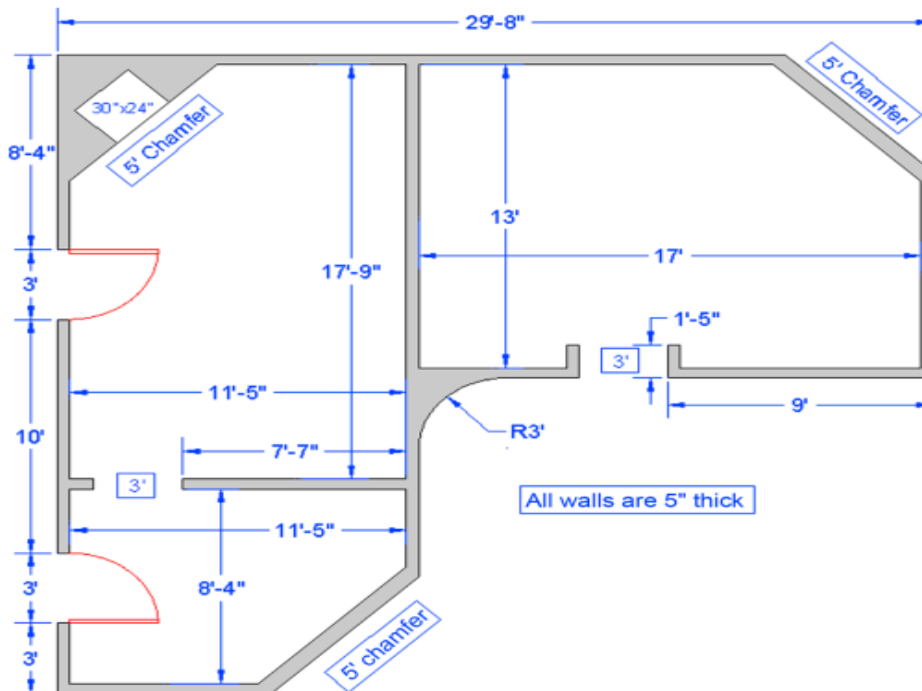
- Road A= 15m width (divider/median=3m)
- RoadB= 7m

Make conflict point diagram.

Note: 1. Show cross conflicts by red circles, diverging conflicts by blue rectangles and merging conflicts by yellow triangles.

2. The connection should not be sharp.

3. Draw the following floor plan. Try different layers and analyze the difference.



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Tutorial 2

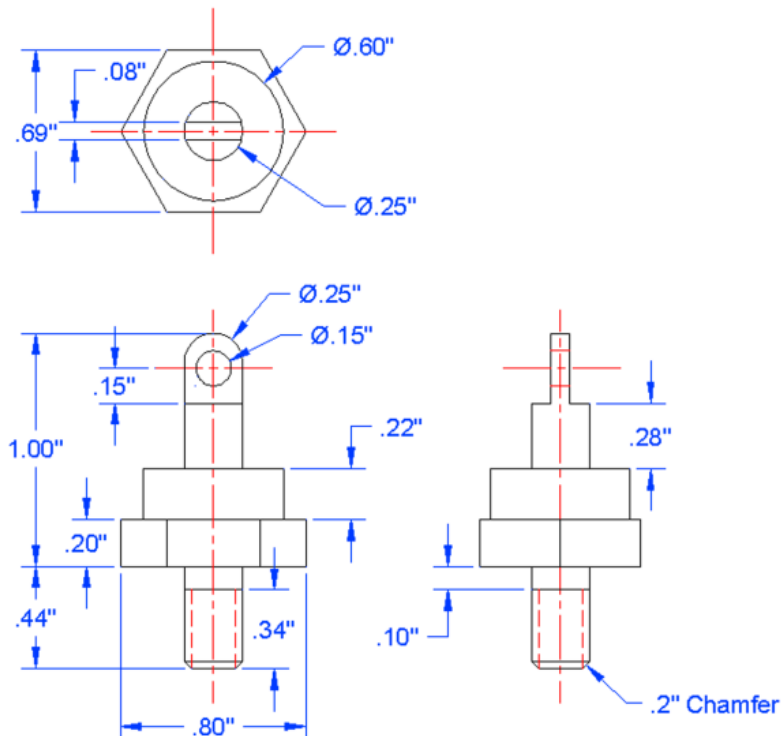
1. Working with SKETCH and ARCTEXT commands along with other basic commands, draw the following logo in AutoCAD with precision.



2. Make a professional title box for your drawing using TEXT and MTEXT commands and analyze the difference between the two.

3. Make a legend/ symbol box with description showing 20 different symbols used in Civil Engineering discipline.

4. Using Center Marks and Center Lines, among other basic tools draw the following in AutoCAD 2017.



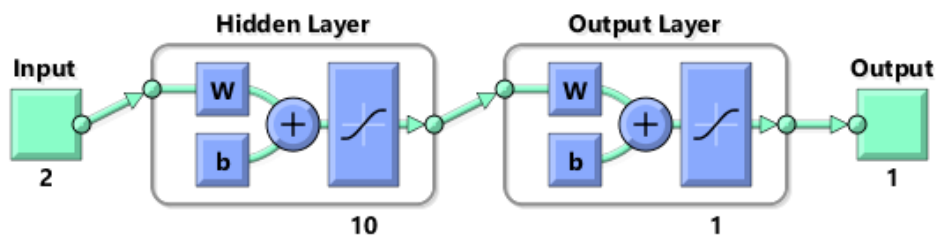
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
Department of Civil Engineering

Subject Code: CIV-705

Course Title: Computer Aided design (CAD)

Tutorial 3

1. What is machine learning? What are the pros and cons while applying it in Civil Engineering problems?
2. Explain the various steps involved in designing the Artificial Neural Network (ANN) in MATLAB software.
3. Identify the diagram shown in figure 3.1. Also explain various stages shown.



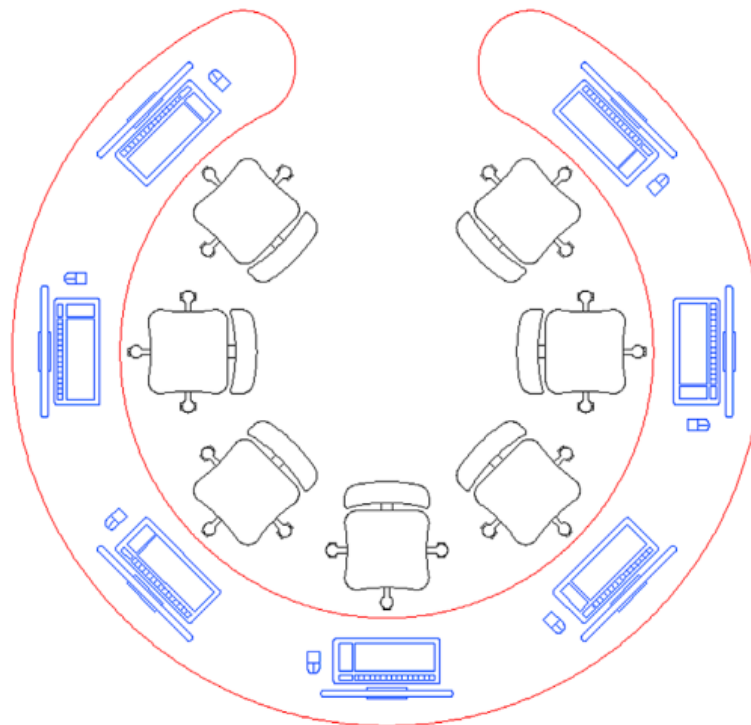
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
Department of Civil Engineering

Subject Code: CIV-705

Course Title: Computer Aided design (CAD)

Tutorial 4

1. Draw 20 different blocks which are required time and again in Civil Engineering drawings. Try out all the three options (i.e. BLOCK, WBLOCK and dynamic-BLOCK) and analyze the difference between the three.
2. In a new file, draw the following polar array, made up of a table, chairs, and computers. No sizing is given and all elements can be approximated. Place each element on the appropriate layer, and make a block out of it prior to using it in the array.



3. What are the essential settings that need to be set up before printing a drawing in AutoCAD?
How does Page Setup Manager make things easier while taking the final output?

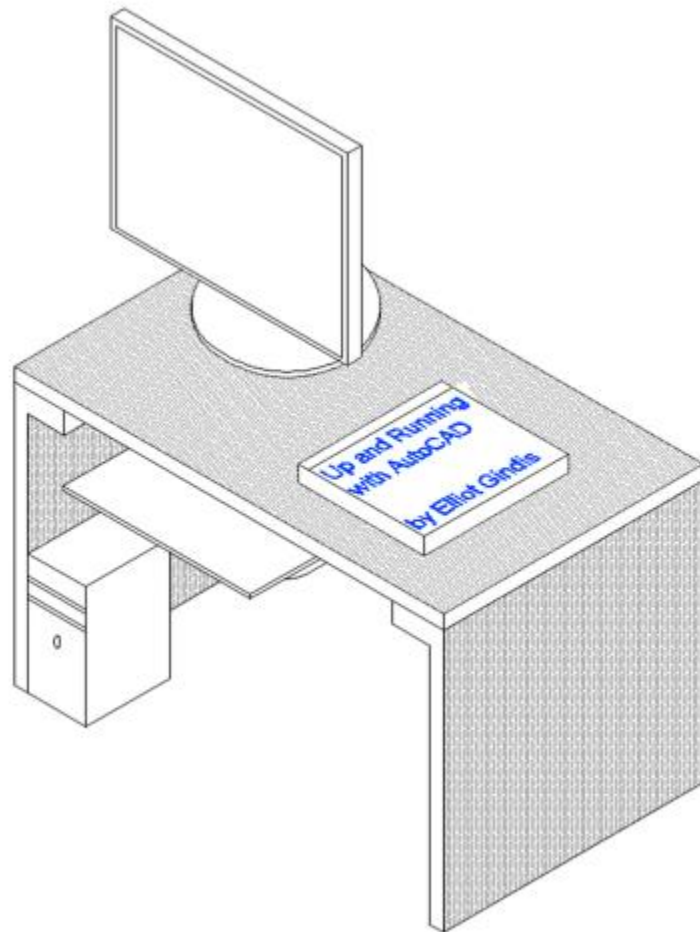
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
Department of Civil Engineering

Subject Code: CIV-705

Course Title: Computer Aided design (CAD)

Tutorial 5

1. Explain the use of F5-key used in Isometric snap in AutoCAD with the help of an example.
2. How do we make circles and text so that it looks a part of the isometric drawing in AutoCAD?
3. Draw the following computer table using isometric snap in AutoCAD. The text however should be changed to “National Institute of Technology Srinagar” followed by your name.



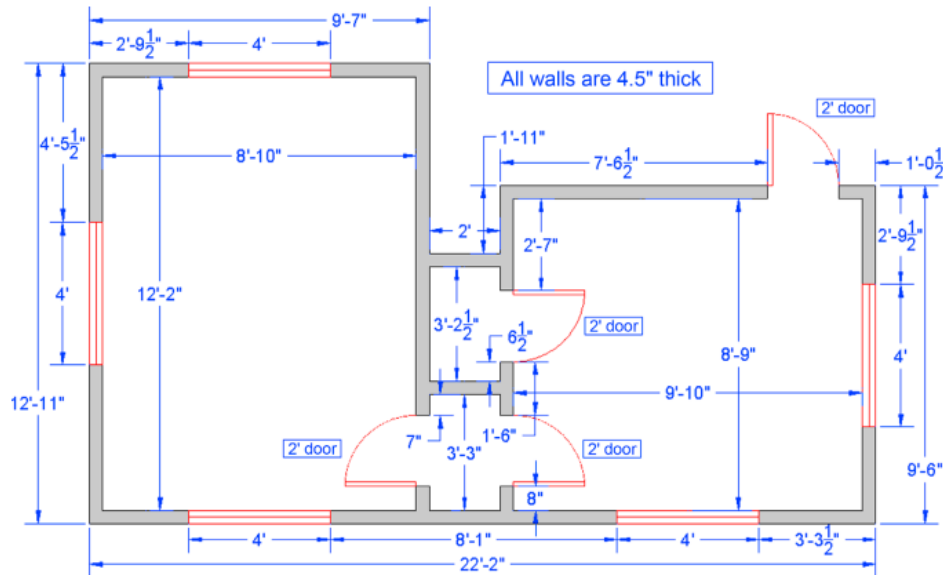
NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
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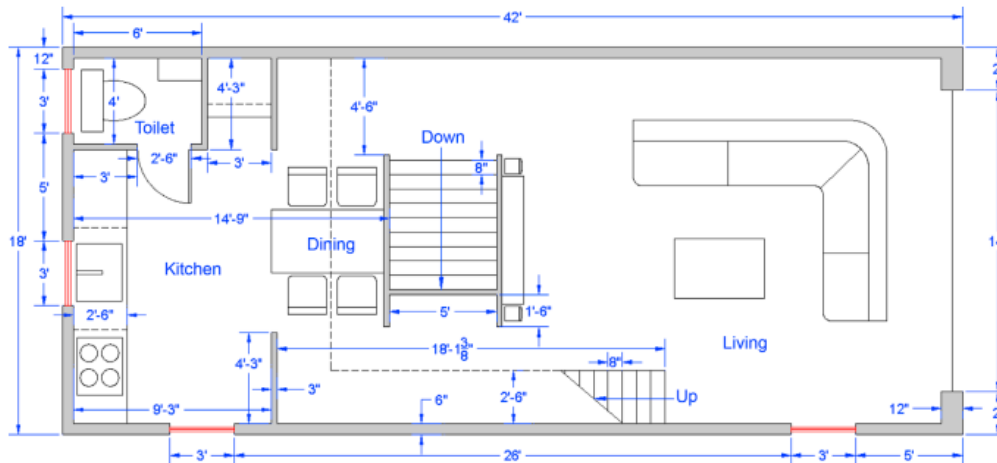
Course Title: Computer Aided design (CAD)

Assignment 1

Q1: In a new file, set up Architectural units, the correct layers (A-Walls, A-Doors, and A-Windows), and draw the following floor plan.



Q2: In a new file, set up Architectural units, the correct layers (A-Walls, A-Doors, A-Windows, and A-Furniture), and draw the following floor plan including the furniture. Those dimensions not expressly given (such as with the furniture, kitchen, and bathroom elements and other minor details of the floor plan itself) can be assumed and free-drawn to appropriate size.



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Department of Civil Engineering

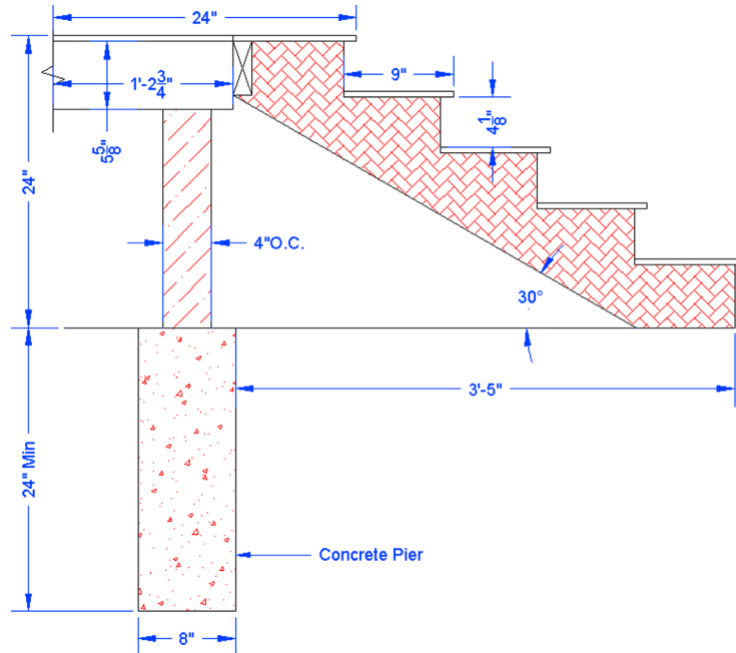
Subject Code: CIV-705

Course Title: Computer Aided design (CAD)

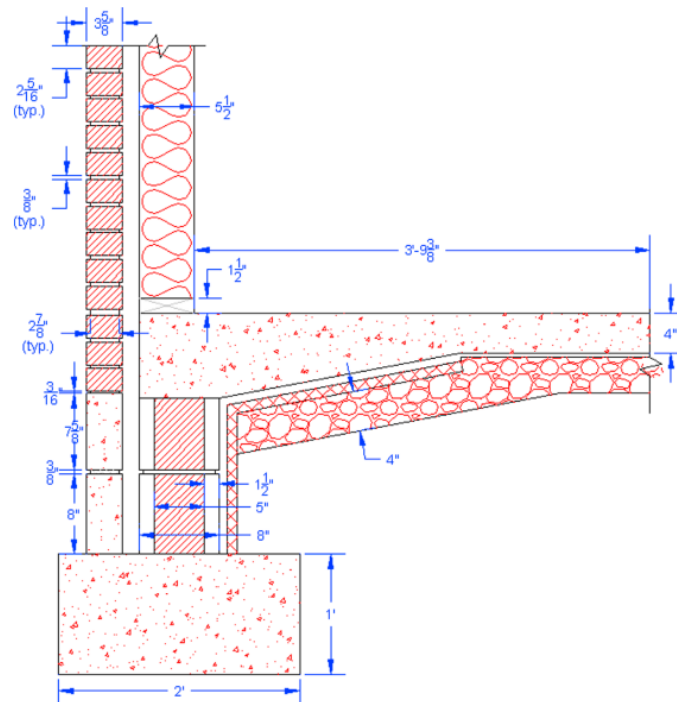
Assignment 2

Q1: Design a logo for Civil Engineering Department in AutoCAD 2017. Apart from using drawing and modify toolbar use SKETCH and ARCTEXT commands.

Q2: Open a new file, create the appropriate layers, and set units to Architectural. Create the stair (shown in figure) layout and hatch patterns. Any sizes and dimensions that are not given can be estimated, as can the scale of the patterns. Add in text where needed.



Q3: Create the following architectural detail. Many (but not all) of the dimensions are given. Use them as a basis to size the rest. Then, approximate the hatch patterns as shown. The squiggly vertical one is not a hatch pattern but a LINETYPE, called Batting, often used to show insulation. Adjust its LTSCALE until it looks like what is shown.



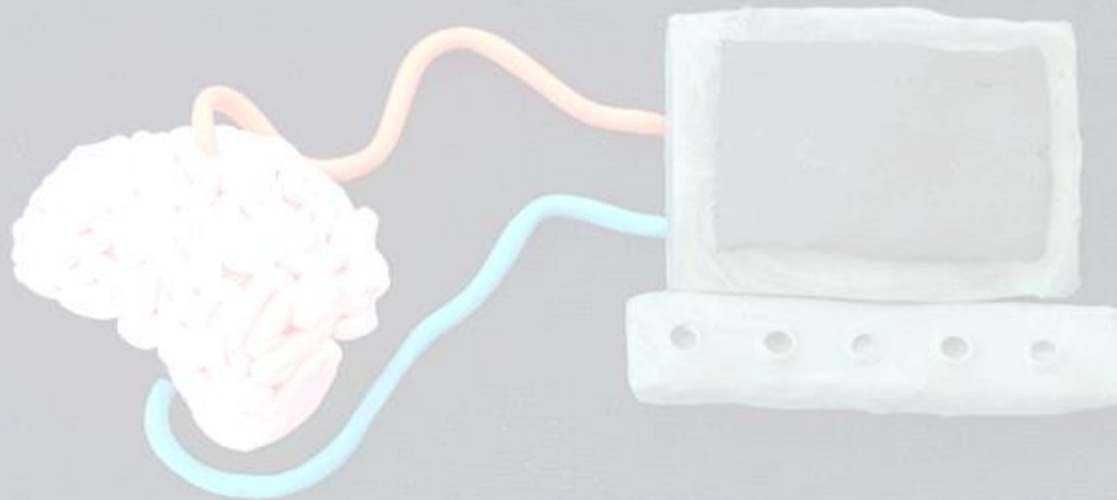


**Machine Learning
Technique– Artificial
Neural Network**



What Is Machine Learning ?

Machine learning is a data analysis technique that teaches computers to do what comes naturally to humans and animals:



Learn from Experience

Machine Learning Techniques

Supervised learning:

Trains a model on known input and output data so that it can predict future outputs.



Unsupervised

learning: Finds hidden patterns or intrinsic structures in input data.

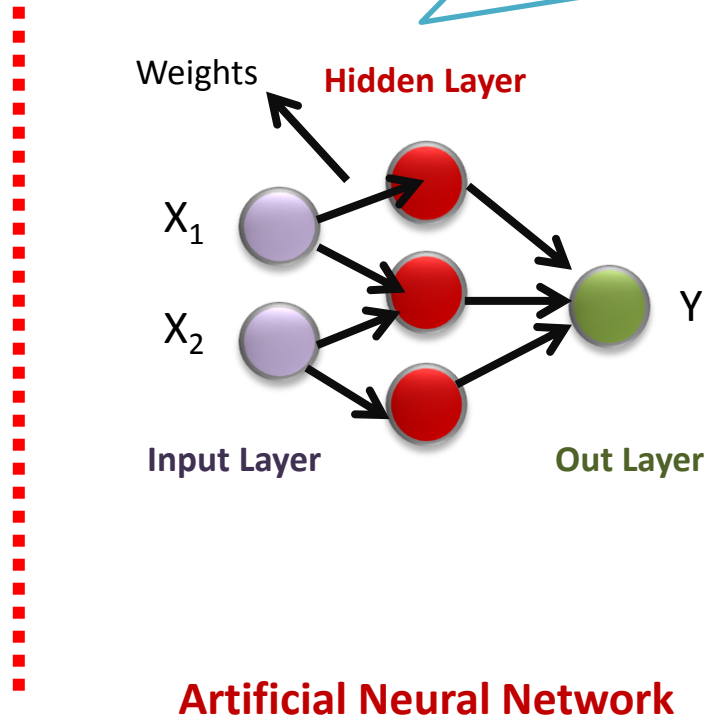
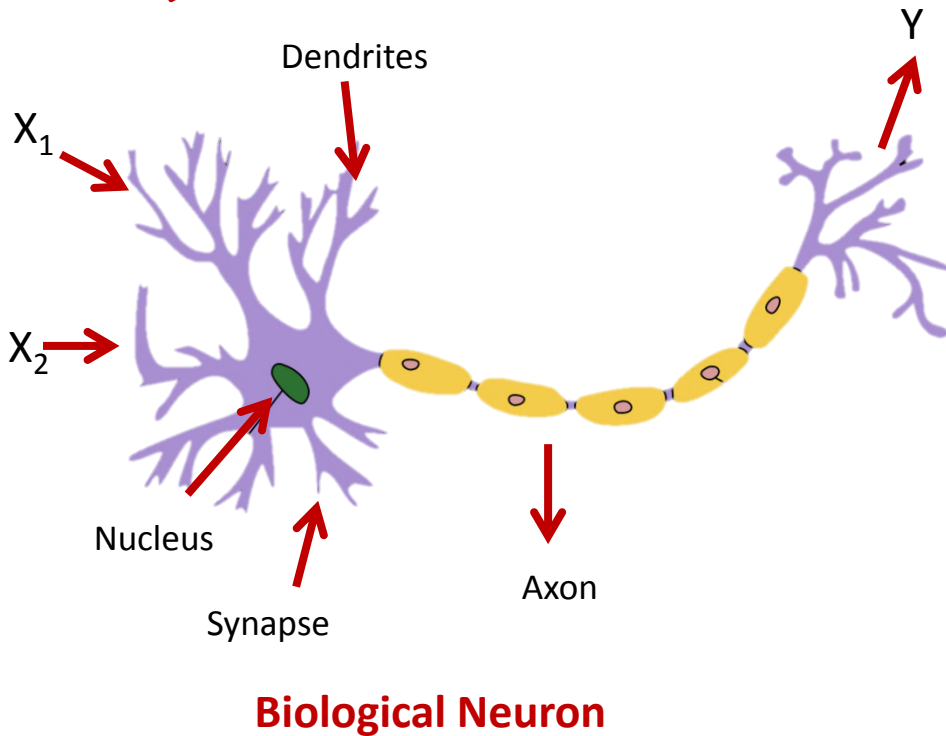


Artificial Neural Network

A biological neuron basically collects the sensed information of different strengths and passes it on to subsequent neurons, if it compares with a stored threshold.

An tries

The summing node/hidden layer accumulates all weighted input signals after adding or subtracting a bias value from it and then passes the result through a transfer function.



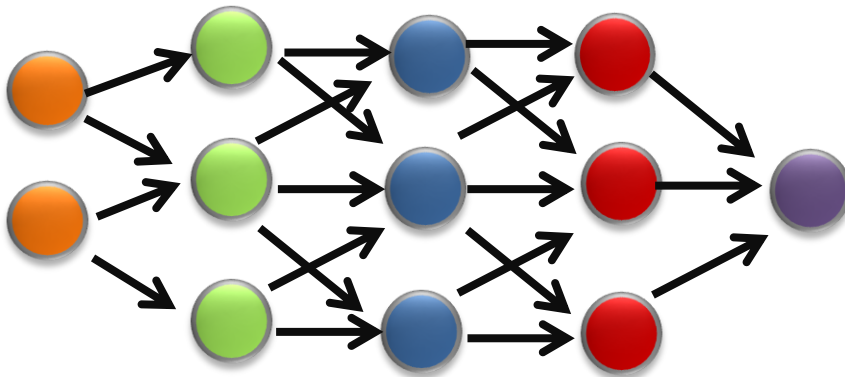
Types of Artificial Neural Networks:

Classification based on number of layers:

Bilayer networks

Multilayer networks

Single layer networks



Working of an Artificial Neural Network:

The goal of ANN is to generalize a relationship of the form:

$$Y^m = f(X^n)$$

Where :

- The most commonly used form of f is the sigmoid function, given as :

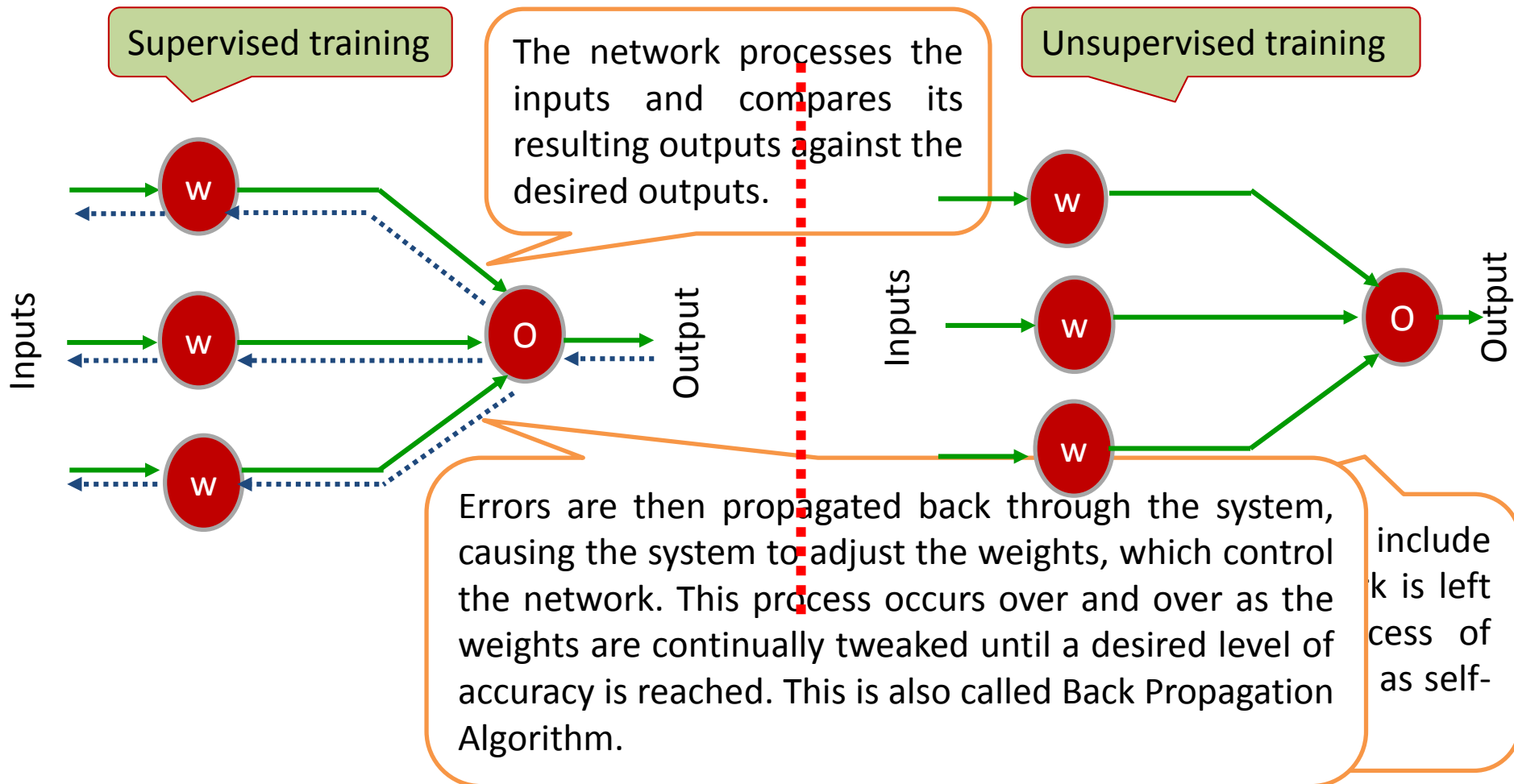
$$f(t) = \frac{1}{1 + e^{-t}}$$

- Y^m is a m dimensional output vector consisting of y_1, y_2, \dots, y_m .
Where $t = \sum (X_1 W_1 + X_2 W_2 + \dots) + \beta$ (β is bias)

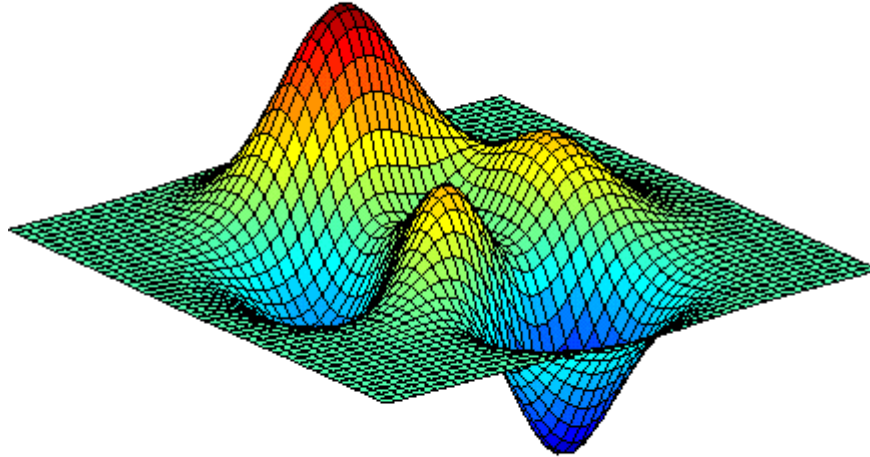
The function f is called an activation function. Its functional form determines the response of the node to the total input signal it receives.

Network Training

Training is a process in which the weights are adjusted such that the error (actual Output – network output) is less than a prescribed value.



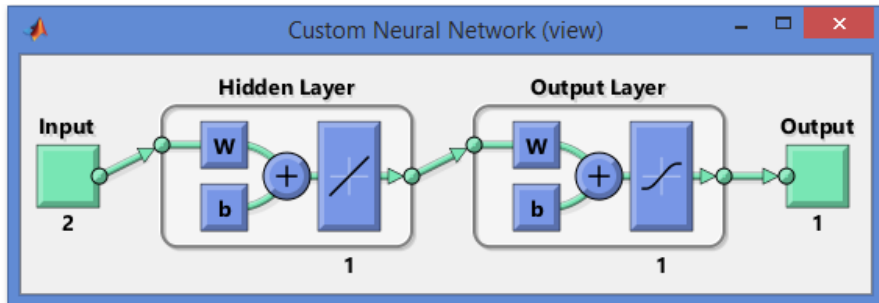
MATLAB



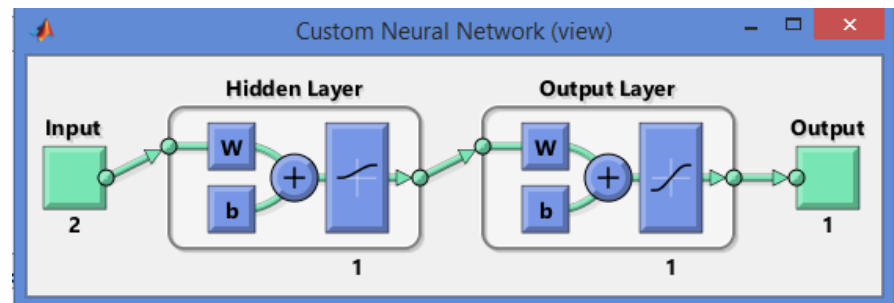
MATLAB (matrix laboratory) is a numerical computing environment and programming language developed by MathWorks.

Artificial Neural Network

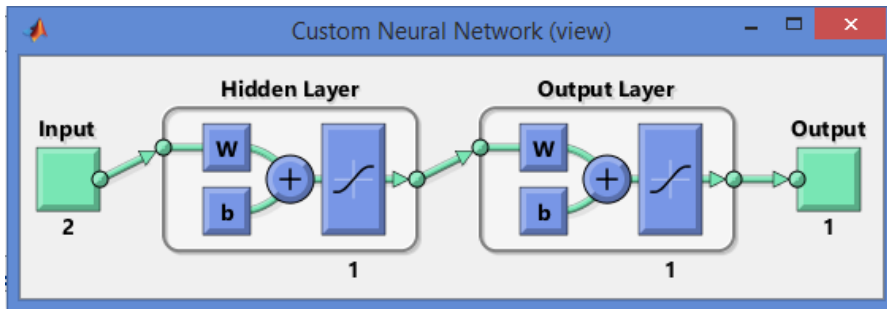
Network with Purelin transfer function (NN_p)



Network with Logsig transfer function (NN_l)



Network with Tansig transfer function (NN_t)



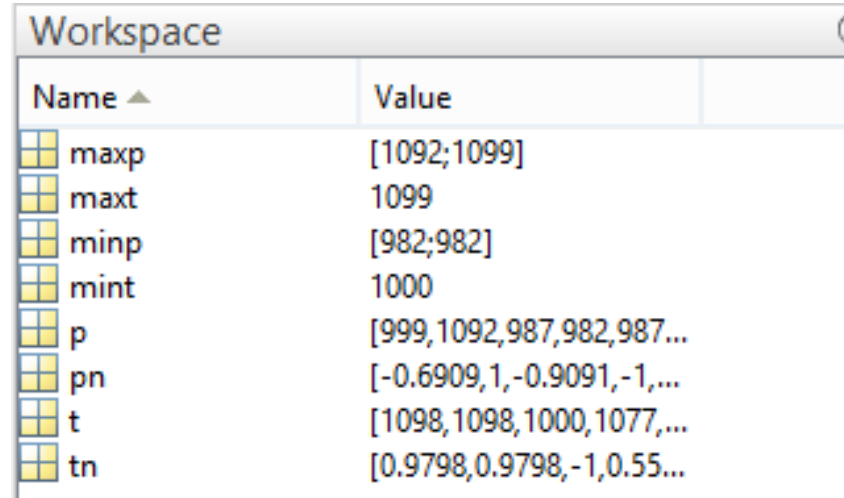
Data Normalization in MATLAB 7.0.1

The function “premnmx” is used to scale inputs and targets so that they fall in the range [-1, 1]. The following code illustrates the use of this function.

```
[pn,minp,maxp,tn,mint,maxt] = premnmx(p,t)
```

p = input matrix
t= target matrix
maxp= maximum value of input
minp= minimum value of input
maxt= maximum value of target
mint=minimum value of target
pn= normalized input matrix
tn=normalized output matrix

View of the files generating while pre-processing using “premnmx”command



The screenshot shows the MATLAB Workspace window with the following variables and their values:

Name ▲	Value
maxp	[1092;1099]
maxt	1099
minp	[982;982]
mint	1000
p	[999,1092,987,982,987...
pn	[-0.6909,1,-0.9091,-1,...
t	[1098,1098,1000,1077,...
tn	[0.9798,0.9798,-1,0.55...

Artificial Neural Network

1. Creating the Network:

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
0.9778    0.6000   -1.0000    1.0000   -0.8222  
-0.0581    1.0000   -0.0465   -0.1860   -1.0000
```

```
minp =
```

```
909  
918
```

```
maxp =
```

```
999  
1090
```

```
tn =
```

```
-1.0000   -0.9780   -0.9121    1.0000   -1.0000
```

```
mint =
```

```
999
```

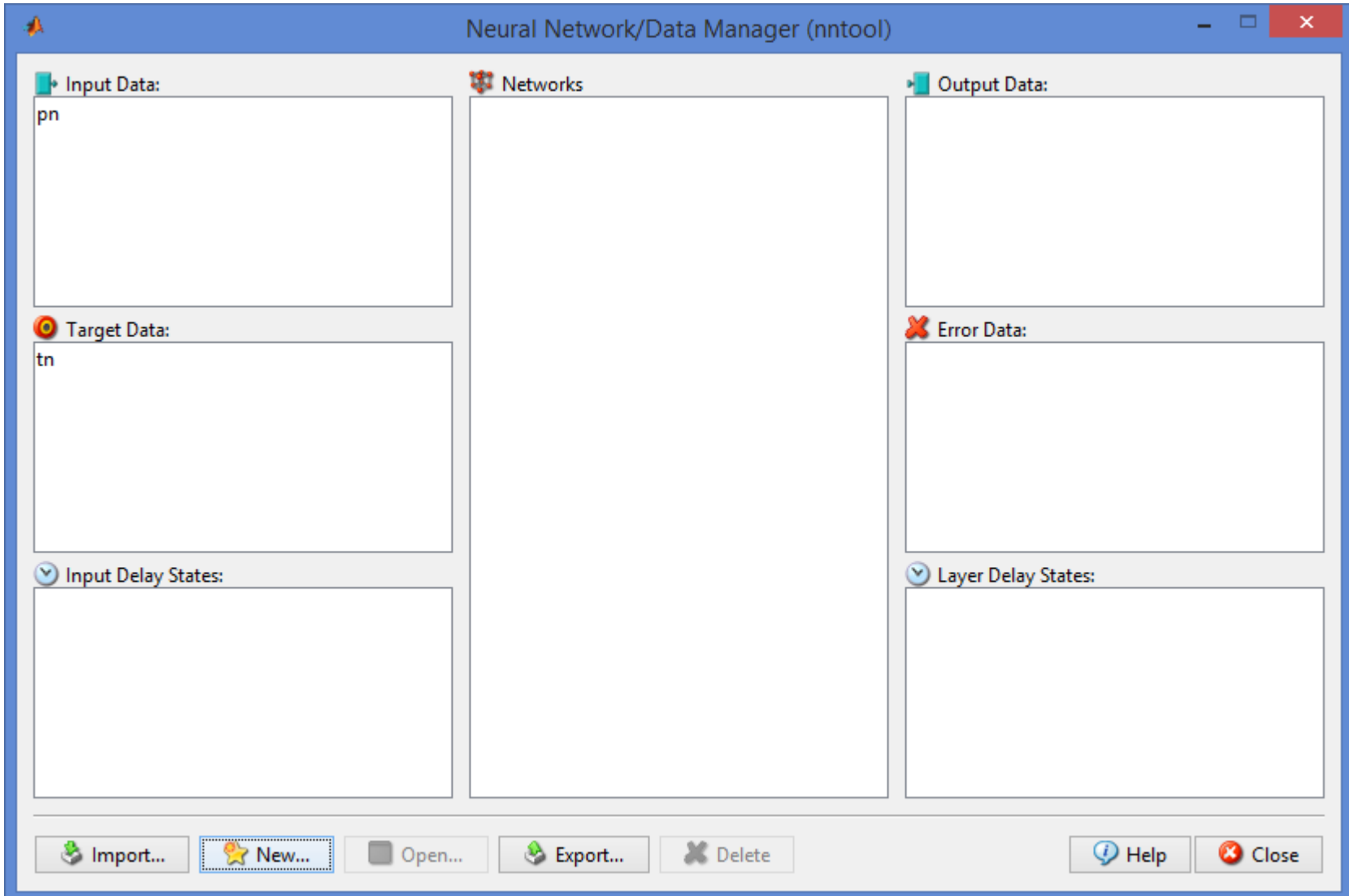
```
maxt =
```

```
1090
```

```
>> nntool
```

Artificial Neural Network

Creating the Network:



Artificial Neural Network

Creating the Network:

Create Network or Data

Network | Data

Name

network1

Network Properties

Network Type: Feed-forward backprop

Input data: pn

Target data: tn

Training function: TRAINLM

Adaption learning function: LEARNGDM

Performance function: MSE

Number of layers: 1

Properties for: Layer 1

Number of neurons: 10

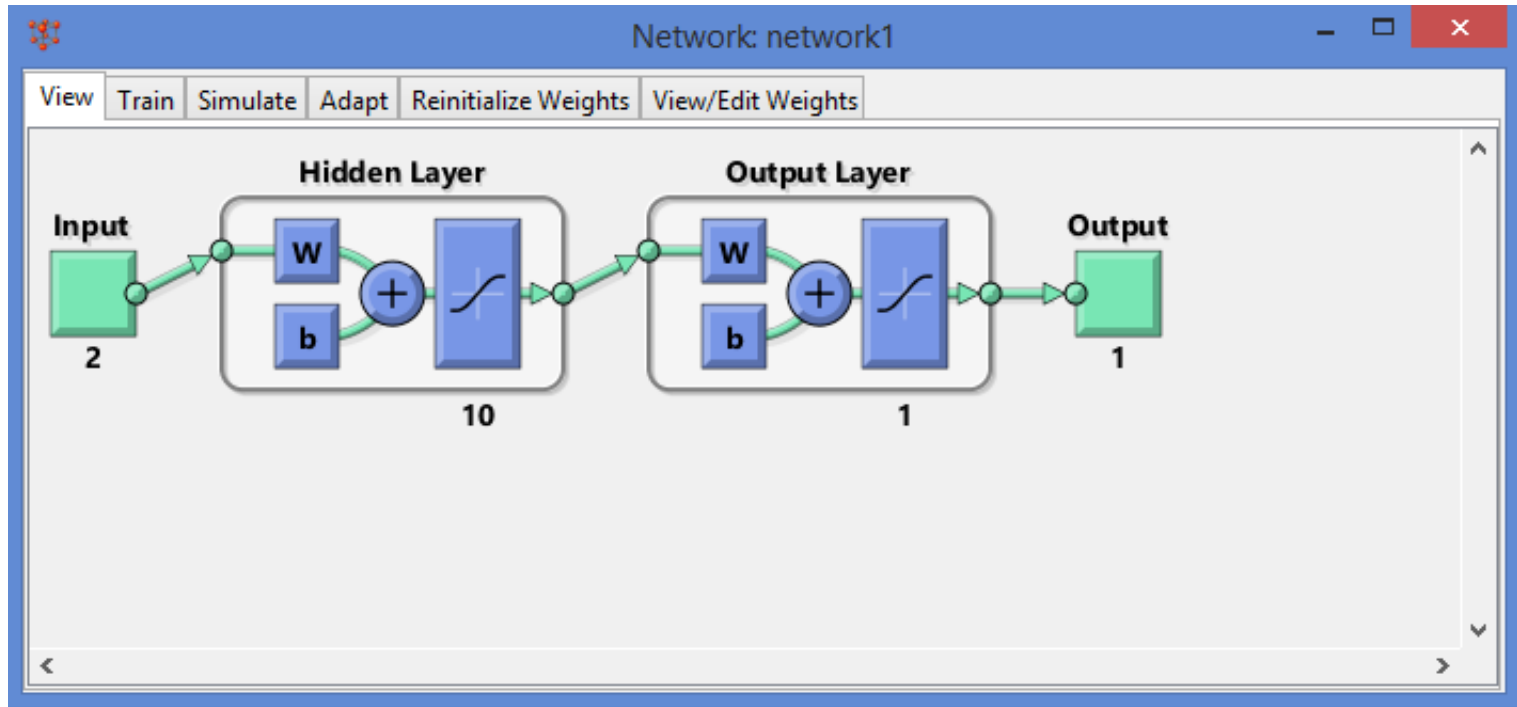
Transfer Function: TANSIG

View | Restore Defaults

Help | Create | Close

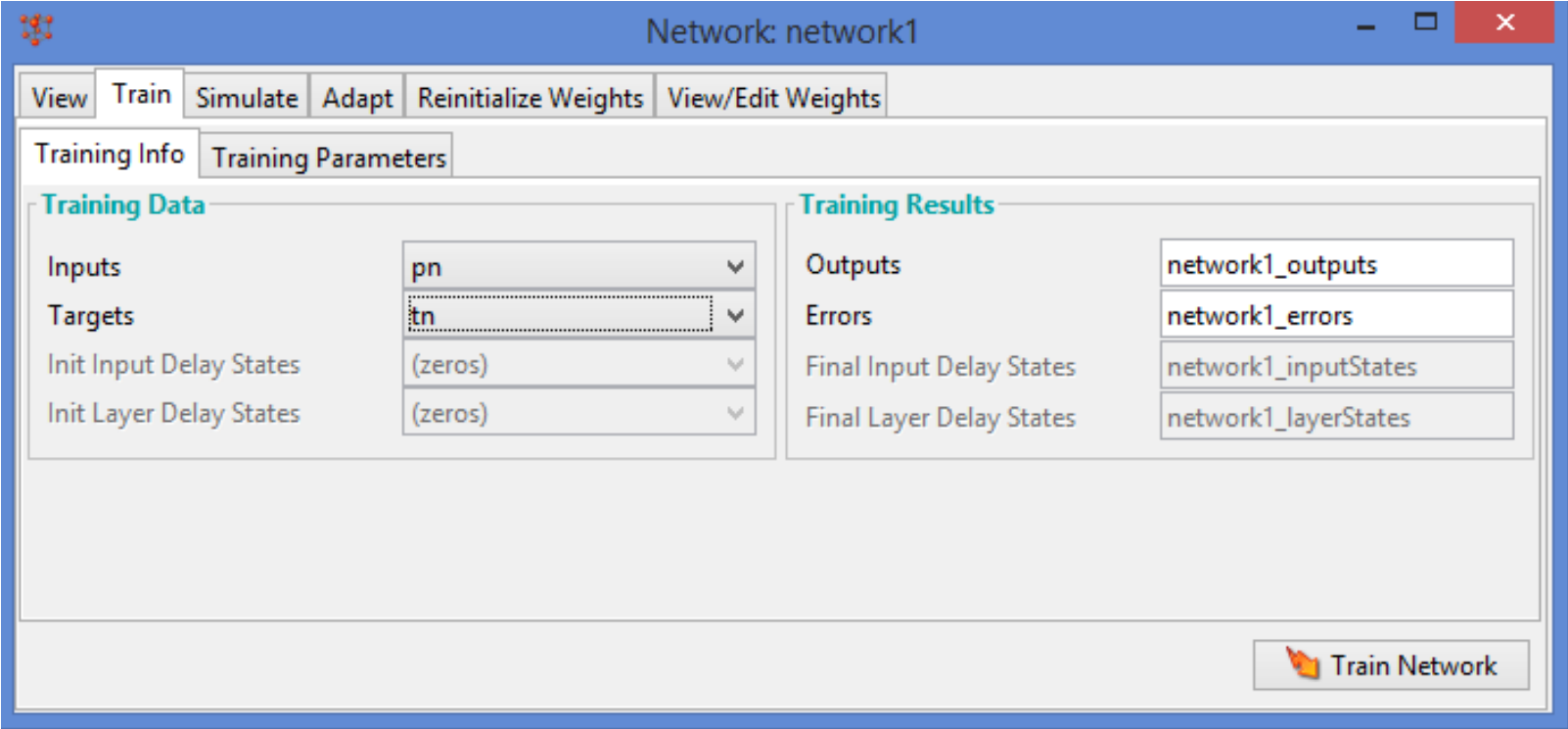
Artificial Neural Network

Creating the Network:



Artificial Neural Network

2. Training the Network



Artificial Neural Network

2. Training the Network

The screenshot displays the Neural Network Training (ntraintool) window. At the top, the title bar reads "Neural Network Training (ntraintool)".

Neural Network: A diagram shows an input layer with 2 nodes, a hidden layer with 10 nodes, and an output layer with 1 node. Each layer contains a weight matrix (W) and a bias vector (b), followed by an addition node (+) and an activation function block.

Algorithms:

- Data Division: Random (dividerand)
- Training: Levenberg-Marquardt (trainlm)
- Performance: Mean Squared Error (mse)
- Calculations: MATLAB

Progress:

Epoch:	0	9 iterations	1000
Time:		0:00:00	
Performance:	1.21	2.11e-06	0.00
Gradient:	0.692	3.99e-05	1.00e-07
Mu:	0.00100	1.00e-09	1.00e+10
Validation Checks:	0	6	6

Plots:

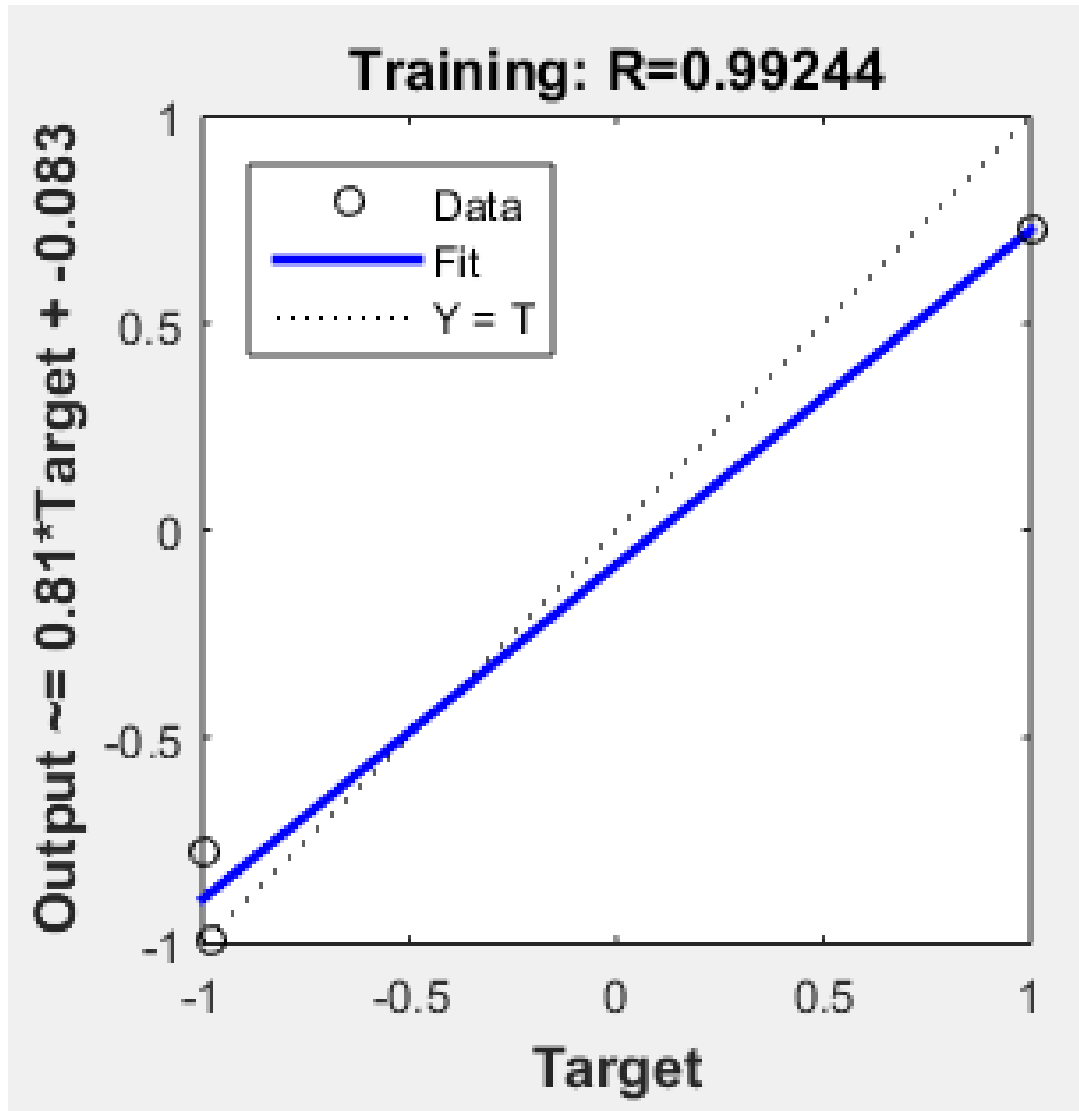
- Performance (plotperform)
- Training State (plottrainstate)
- Regression (plotregression)

Plot Interval: epochs

Validation stop. (indicated by a green checkmark)

Buttons: Stop Training, Cancel

Artificial Neural Network



Artificial Neural Network

Post Training Analysis

```
>> a=sim(net,pn);  
>> [m,b,r]=postreg(a,tn)
```

```
m =
```

```
0.2267
```

```
b =
```

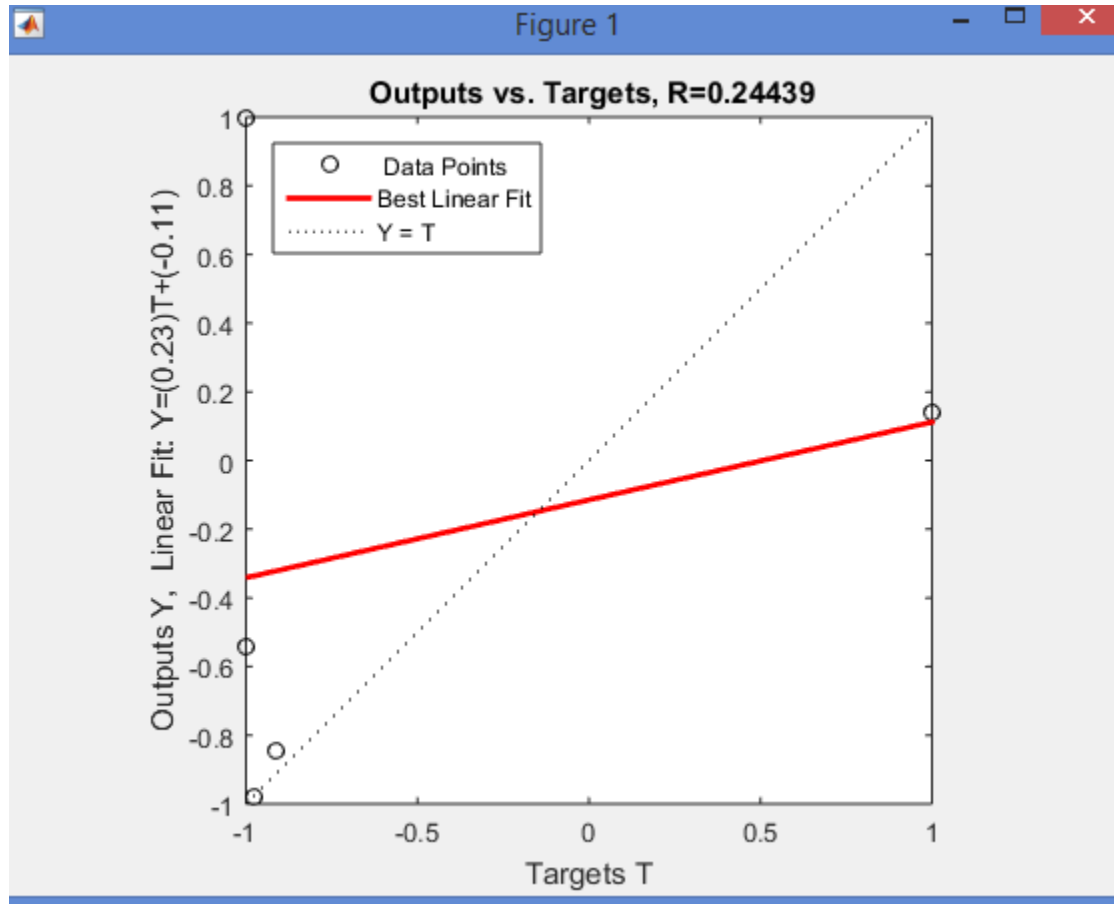
```
-0.1147
```

```
r =
```

```
0.2444
```

Artificial Neural Network

Post Training Analysis



Artificial Neural Network

COMPARISON OF PREDICTABILITY OF MODELS

The results obtained by NN_p, NN_t, NN_{pt} and NN_{tp} were compared by means of Mean Square Error (MSE), Root Mean Squared Error (RMSE), Absolute Average Deviation (AAD) % and R².

Where y_p = predicted value
 y_a = actual value
 y_m = average of actual values
 n = number of observations

$$MSE = \frac{1}{n} \sum_{i=1}^n (y_p - y_a)^2$$

Where, $RMSE = (MSE)^{\frac{1}{2}}$

$$R^2 = 1 - \frac{\sum_{i=1}^n (y_p - y_a)^2}{\sum_{i=1}^n (y_a - y_m)^2}$$

$$AAD = \left\{ \left[\sum_{i=1}^n (|y_p - y_a| / y_a) \right] / n \right\} \times 100$$

The model having minimum MSE, RMSE and AAD and with maximum R² is considered as the best model.

n	=	No. of observations
y_p	=	predicted value obtained from the model
y_a	=	actual value
y_m	=	average of actual values

Results and Discussions

Post Regression Analysis:

COMPARISON OF PREDICTABILITY OF MODELS

The results obtained by MLR were compared with those obtained by NN_p , NN_t , NN_{pt} and NN_{tp} on the basis of values of MSE, RMSE, R^2 and AAD%.

The values of these parameters for the five models are given in Table below:

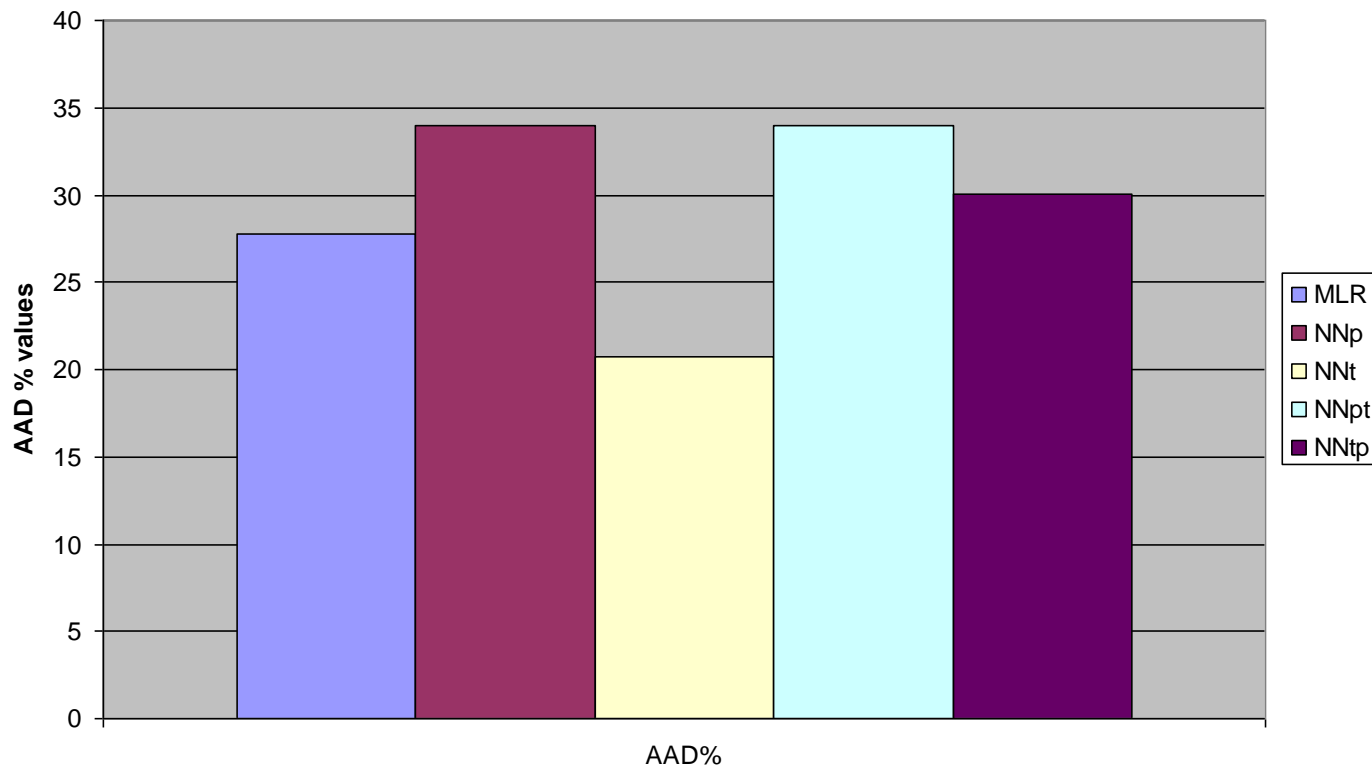
S.NO.	MODEL NAME	MSE	RMSE	R SQUARE	AAD%
1	MLR	0.0204946	0.1431594	0.830458	27.76616
2	NN_p	0.020656	0.143721	0.829124	33.97264
3	NN_t	0.009394	0.096922	0.922289	20.7275
4	NN_{pt}	0.020656	0.143721	0.829125	33.97264
5	NN_{tp}	0.008899	0.094336	0.926381	30.01107

Post Regression Analysis:

COMPARISON OF PREDICTABILITY OF MODELS

NN_t model gave minimum value of AAD% as 20.7275%.

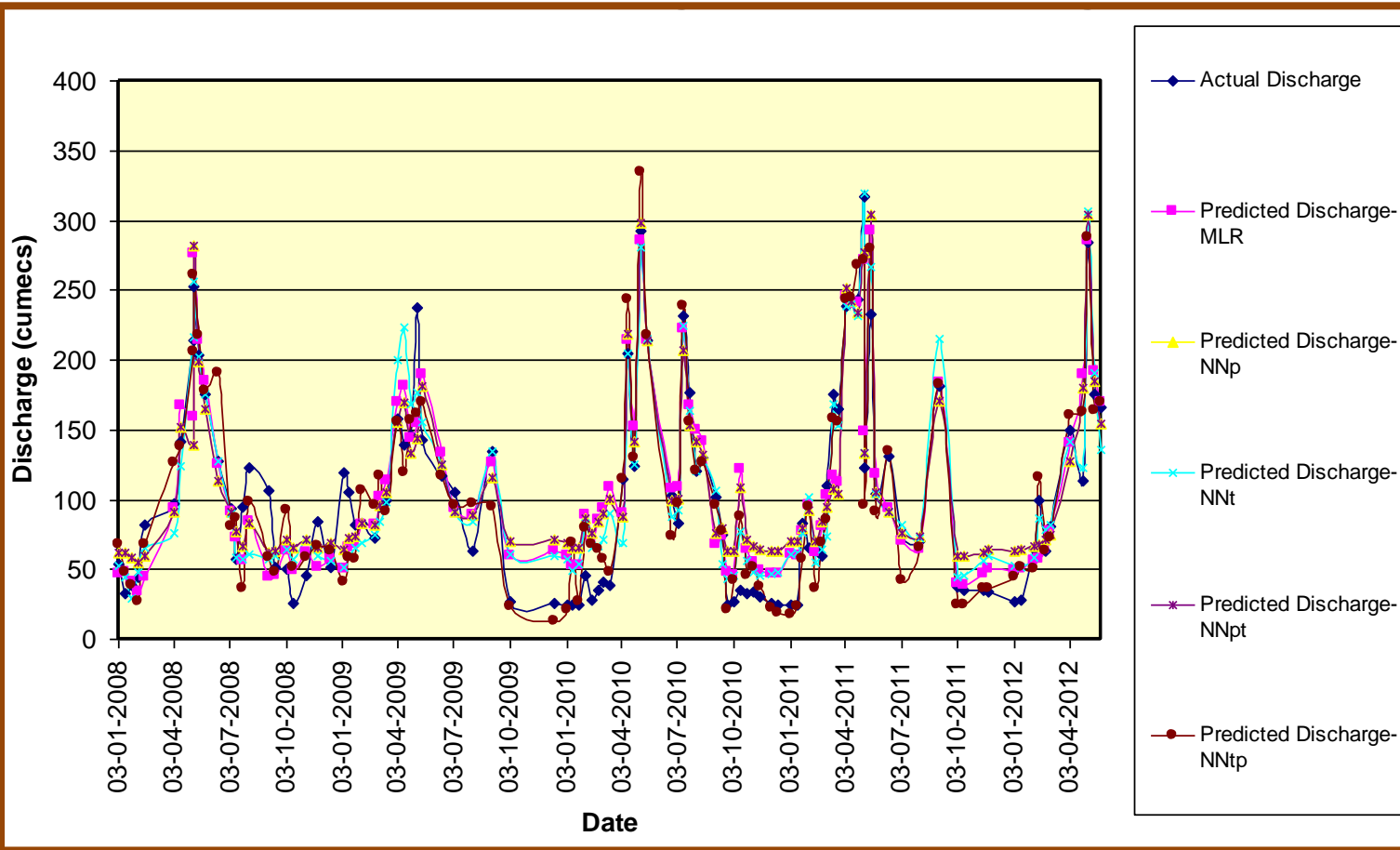
NN_{tp} model gave maximum value of R² as 0.926381.



least values
36

least
08899

VALIDATION OF THE FLOOD PREDICTION MODELS



Assignment:

1. Applications of MATLAB.
2. Neural Network Applications in modeling Civil Engineering problems.
3. Advantages and Limitations of Artificial Neural Networks.

Thank
You