College of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)

Department of Applied Science

Intellectual Property Rights (First Year M.Tech. 2011-12)

Total Marks: 40 **Time: Two hours** **May , 2012**

Instructions: a) Answer any 4 Questions.
b) All Questions carry equal marks.

Q. 1) Write in brief about the concept and nature of Intellectual Property and explain any two types of Intellectual Properties. **10 marks**

OR

Explain Patents and write about the Patent Granting System in India.

Q. 2) Write a note on the International Scenario in relation to Intellectual Property and its Protection. Also explain in brief WIPO (World Intellectual Property Organization) **10 marks**

OR

Write a note on PCT and the procedure for patenting under the PCT (Patent Co-operation Treaty)

Q. 3) Write short notes: (any 2) **10 marks**
a) IPR and IITs
b) Registered and unregistered Trade Marks
c) Design
d) Idea Patenting

Q. 4) Explain Geographical Indications and give a case study. **10 marks**

OR

Explain Traditional Knowledge and give a case study.

Q. 5) Write in brief about the new developments in IPR. **10 marks**

OR

Explain the process of patenting and development.

****** BEST OF LUCK! ******

College of Engineering, Pune

End Semester Examination – May 2012

M. Tech. - F.Y. (Institute Level open Elective)

ME5107 Finite Element and Boundary Element Methods

Day and Date- Friday, May 04, 2012 Time: 09.00 am – 12.00 noon

Maximum Marks: 50 Duration – 3 hrs.

Instructions:

1. All questions are compulsory; they carry equal marks.
2. Answer precisely and only to the point. Draw figures to elaborate your answer, wherever necessary.

Q.1 a. State any seven steps, arranged in a logical sequence, for implementing FEM applied to a boundary value problem stated by a differential equation. How do we identify primary and secondary variables in a problem from the weak form of weighted residual statement of a boundary value problem? **05**

b. Obtain by FEM, the elongation of the free end of the bar shown in fig.1 hanging under its own weight, using two bar elements. Let area of cross section of the bar, A, be 1350 mm^2, $E = 210$ GPa, and total length, $L = 1.50$ m. Use information given in the annexure at the end of this question paper. **05**

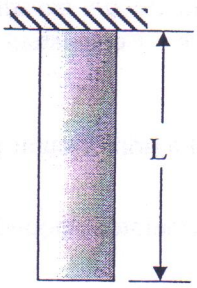
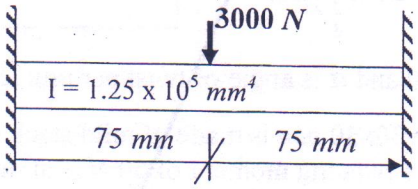


Fig. 1

Q.2 a. Find the deflection at the point of application of the load by FEM for the fixed beam shown in the fig. 2. Consider the stiffness matrix and generalized displacement vector given at the end of this question paper. **06**



E = 200 GPa

Fig. 2

b. Differentiate between 'Nodal Solution' and 'Element Solution' by taking an example of plane stress problem with three 4-noded quadrilateral elements sharing some nodes. **02**

c. List any two sources of error inherited in FEM. Explain two remedies to minimize any one of them. **02**

Q. 3 a. Evaluate the following using 2x2Gauss quadrature scheme of numerical integration:

$$I = \int_{-1}^{+1}\int_{-1}^{+1}(\xi^2 + 5\xi\eta + 3\eta^2)d\xi d\eta\,;\quad GP = \left[+\frac{1}{\sqrt{3}} \quad -\frac{1}{\sqrt{3}}\right] \text{ and GW} = [+1 \;\; +1].$$

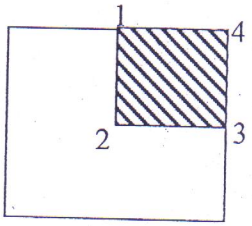
04

Q. 3 b. Explain briefly, practical considerations for modeling a problem for solution by FEM with reference to element shape, aspect ratio, value of Jacobian, mesh density, modeling of curved boundaries, and geometrically degenerated elements. **04**

Q. 4 a. Obtain *consistent element-level mass matrix*, in case of solution for finding undamped natural frequencies of axial vibration of a thin bar by Galerkin-FEM. Consider a bar element with two nodes. Let length of the element = l, 2 m, Modulus of Elasticity = E, 210 GPa, Volume density of the material of the beam = ρ, 7800 kg/m^3, axial displacement of the bar = u, Circular frequency of natural vibration = ω. The vibrations are governed by the differential equation, $E\frac{d^2u}{dx^2} + \rho\omega^2 u = 0$. Stiffness matrix for a bar element is given at the end of this question paper. **06**

b. Find the eigenvalues λ_1 *and* λ_2 and eigenvectors $\{U(x)\}_{2x1}$ for the problem in Q.4 *(a)* above using *Jacobi transformation method.* Consider only one element and lumped mass matrix *or* consistent mass matrix obtained in Q. 4 *(a)*. **06**

Q. 5 Torsion of a non-circular prismatic bar is governed by following differential equation and the associated boundary conditions: $\left(\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2}\right) + 2 = 0$ in the domain and $\phi = 0$ on the boundary. ϕ is a stress function. **10**



The shear stresses and twisting moment are given by

$$\tau_{xz} = G\alpha\frac{\partial\phi}{\partial y} \text{ and } \tau_{yz} = -G\alpha\frac{\partial\phi}{\partial x};\quad M_t = 2G\alpha\int_A\int\phi dA$$

G is Modulus of elasticity of the material and α is angle of twist per unit length

A prismatic bar of a square cross section 30x30 *mm* is made of mild steel, fixed at one end and free at the other, is subjected to a twisting moment of 50 *N.m* at the free end. Taking advantage of symmetry, the cross section was discretized as shown; only one 4-noded quadrilateral was used. The solution was obtained as

$\phi = [\phi_1 \quad \phi_2 \quad \phi_3 \quad \phi_4]^T = [0 \quad 11.4 \quad 0 \quad 0]$

Obtain the values of shear stresses at the centre of the section which can be considered as origin of x-y coordinate system. Take $G = 80$ GPa

Shape functions for a four-noded quadrilateral are given at the end of this question paper.

Annexure to question paper – M Tech (ILOE Mech) FE and BE Methods, May 2012

Shape functions for a 2-noded bar element: $N_1 = \frac{1}{2}(1-\xi)$; $N_2 = \frac{1}{2}(1+\xi)$;

Stiffness matrix for 2-noded bar element: $[K^e] = \frac{AE}{l_e}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$

Stiffness matrix and generalized displacement vector for the beam element

$$[K^e]\begin{Bmatrix} v_1^e \\ \frac{dv_1^e}{dx} \\ v_2^e \\ \frac{dv_2^e}{dx} \end{Bmatrix} \equiv \frac{EI}{l^3}\begin{bmatrix} 12 & 6l & -12 & 6l \\ 6l & 4l^2 & -6l & 2l^2 \\ -12 & -6l & 12 & -6l \\ 6l & 2l^2 & -6l & 4l^2 \end{bmatrix}\begin{Bmatrix} v_1^e \\ \frac{dv_1^e}{dx} \\ v_2^e \\ \frac{dv_2^e}{dx} \end{Bmatrix}$$

Shape functions and their derivatives for a 4-noded quadrilateral element:

$$N_1 = \frac{1}{4}(1-\xi)(1-\eta) \qquad N_2 = \frac{1}{4}(1+\xi)(1-\eta)$$

$$N_3 = \frac{1}{4}(1+\xi)(1+\eta) \qquad N_4 = \frac{1}{4}(1-\xi)(1+\eta)$$

$$\frac{\partial N_1}{\partial \xi} = -\frac{1}{4}(1-\eta) \qquad \frac{\partial N_2}{\partial \xi} = \frac{1}{4}(1-\eta) \qquad \frac{\partial N_3}{\partial \xi} = \frac{1}{4}(1+\eta) \qquad \frac{\partial N_4}{\partial \xi} = -\frac{1}{4}(1+\eta)$$

$$\frac{\partial N_1}{\partial \eta} = -\frac{1}{4}(1-\xi) \qquad \frac{\partial N_2}{\partial \eta} = -\frac{1}{4}(1+\xi) \qquad \frac{\partial N_3}{\partial \eta} = \frac{1}{4}(1+\xi) \qquad \frac{\partial N_4}{\partial \eta} = \frac{1}{4}(1-\xi)$$

College of Engineering, Pune
End Semester Exam – May 2012
F.Y. M.Tech
(IS-502-8)- (Open Elective -Artificial Intelligence)

Day & Date-
Maximum Marks: 50

Time: -
Duration – 3 hrs.

Instructions:

1) All questions are compulsory
2) Neat Diagrams must be drawn wherever necessary.
3) Assume suitable data, if necessary.
4) Figures to the right indicate full marks.
5) Use of non-programmable electronic calculator is allowed.

Q. 1 A Given following predicates 04

Brother(x,y) : x is brother of y
Sibling (x,y) :x is a sibling of y
Parent(x,y) : x is the parent of y
Mother (x,y) x is the mother of y
Female(x) : x is a female
Male(x) : x is a male
Cousin(x,y) : x is a first cousin of y
Represent following statements using these predicates

1. Brothers are siblings
2. Siblings are reflexive
3. One's mother is one's female parent
4. A first cousin is a child of a parent's sibling

B Discuss with example non monotonous reasoning. 04

Q. 2 Explain various approaches for mixed mode chaining and their importance. 08

Given the following approach for mixed chaining:

- The default method for chaining is always backward chaining.
- Rules are not partitioned according to whether there is a priority to either forward or backward chaining.
- Whenever a rule is fired, the premises of all remaining rules are examined to see if they may be fired (i.e. we revert to forward chaining).
- If so they are fired.
- If not, we continue backward chaining.

Use this procedure to deal with the following rule set

1. If F and H then K
2. If E and A then K
3. If E and B then H
4. If A and G then B
5. If B and D then H
6. If G and D then E
7. If A and B then D
8. If A and C then G

Given A and C, determine K.

Q. 3 Discuss how the concept of certainty factor used in an Expert system. 08
Consider the rule R1 given as
If (P1 and P2 and P3) or (P4 and Not P5) then C1 (0.7) and C2 (-0.5)
The certainty factors for P1, P2, P3, P4 and P5 are 0.8, 0.7, 0.6, 0.9, -0.5 respectively.
What are the certainty factors associated with conclusions C1 and C2 after using rule R1?
Another rule R2 also produces conclusions C1 and C2 with certainty factors associated with conclusion C1 and C2 as 0.7 and -0.4 respectively.
What are the certainty factors associated with C1 and C2 after combining the evidences from C1 and C2.

Q. 4 A perceptron learns to perform a binary NAND function on inputs x_1 and x_2. The training set, represented as ((input vectors), desired output) for the four samples is : 08
{ ((0,0),1), ((0, 1),1), ((1,0),1), (1,1),0))}
Inputs: x_0, x_1, x_2, with input x_0 held constant at 1. Threshold (t): 0.5
Learning rate (Correction) is to be taken as 0.1 times the iteration error (i.e. desired output- network output) . Let the initial weights w0,w1,w2 be 0.6, -0.2, -0.1 respectively.
Develop the perceptron. Show all iteration steps in details.

Q.5 Discuss various steps of Natural Language Processing with example. 08
A simple Context-free phrase structure grammar fro English:

1. S → NP VP
2. NP → the NP1
3. NP → PRO
4. NP → PN
5. NP → NP1
6. NP1 → ADJS N
7. ADJS → ε | ADJ ADJS
8. VP → V
9. VP → V NP
10. N → file | printer
11. PN → Bill
12. PRO → I
13. ADJ → short | long | fast
14. V → printed | created | wan

Develop a parse tree to check if the statement "Bill printed the file" is syntactically correct.
Show all steps clearly. E indicates an empty string.

Q.6 A fuzzy system uses following membership functions 10
Tall (x)= 0 if height < 5 ft
= (height (x) – 5 ft)/ 2 ft if 5 ft <= height(x) <= 7 ft
= 1 otherwise
Old (x)= 0 if age < 18 yr
= (age (x) – 18 yr / 42 yr if 18 yr <= age(x) <= 60 yr
= 1 otherwise
Plot the membership functions.For the following data,

height	3'2"	5'5"	5'9"	5' 10"	6' 1"	7'2"	3"4"
age	65	30	27	32	31	45	4

Compute the sets A, B and C given as
A= x is Tall and x is Old
B= X is Tall or x is Old
C= Not x is Tall

PIET's COLLEGE OF ENGINEERING, PUNE
(An Autonomous Institute of Government of Maharashtra)
Test: End Semester Exam
Institute Level Open Elective
(PE-5164) Reliability Engineering
Programme: F.Y. M .Tech
Year: 2011-12 Semester II
Duration: 3 hrs Max. Marks: 50
Date: 04/05/12

Instructions:
1. All questions are compulsory.
2. Assume suitable data if required.
3. Figures to right indicate full marks.
4. Draw neat figures where ever required.

Q.1 a) The following data refer to predicted reliability of six components in series. In case the desired reliability of the system is not fall below 0.85 find the reliability goal for individual components.

Components	1	2	3	4	5	6
Predicted reliability	0.994	0.998	0.990	0.996	0.990	0.980

(5)

b) What is meant by heated Ferrography and how is it done ? Explain your answers through wear particles concentration, severity index and distinguishing colors for the elements.

Q.2 a) Describe the non-parametric evaluation of reliability using K statistics, when the sample size is 20, with no failure occurring, but maximum & minimum limits are provided for the output yield. (5)

b) A vibration monitoring system consists of six sub-systems, all connected in series. The predicted reliabilities as obtained from an analysis are R1= 0.993, R2= 0.996, R3 = 0.998, R4= 0.997, R5=0.987, R6= 0.989. Calculate the system reliability. If it is desired to increase the reliability by 3%, determine the percentage by which the reliability of each sub-system should be increased. Assume an exponential model for each subsystem. (4)

Q.3 a) If in a system we need at least one out of 3 units to operate for the successful working of the system, then prove that the system reliability can be written as: (4)

$$Rs(t) = 3e^{-\lambda t} - 3e^{-2\lambda t} + e^{-3\lambda t}$$

Where λ-constant failure and t-mission time.

b) Find out the mean lives of the components so that the system reliability becomes 0.96 using AGREE method, the data being given below. (4)

Sr. No. Components	No. of Component Modules (n_i)	Optg Time (t_i)	Prob. of system due to failure of subsystem (w_i)
1	4	12	0.10
2	8	4	0.20
3	6	10	0.25
4	13	15	0.25
5	10	10	0.20

State any assumptions made.

Q.4 Write short notes on: (Any two)

i) Matrix method of estimating reliability of the system.
ii) Quantum debris analysis for finding out trend of failure
iii) Tie set or Cut set theory of System Reliability.
iv) Criticality Analysis through RPN in FMECA.

Q.5 a) MTTF and MTTR of an arc-welding Robot are 50 and 5 hours respectively. Find out the availability of the Robot what will be the availability if MTTR is reduced to 2 hours? Give an one example each where availability is important rather than reliability and vice versa ?

b) Derive an expression for availability using Markovian model.

Q.6 a) The mean and the standard deviation of a bolted joint are 3000 Kg/cm^2 and 280 Kg/cm^2 respectively. The joint is loaded such that stress induced has a mean value of 2530 Kg/cm^2 with a standard deviation of 42 Kg/cm^2. Assuming that shear strength and the induced stresses are independent and normally distributed, find out the probability of survival of the bolted joint. Extract of data from statistical table is given below:

Z	1.2	1.3.	1.4	1.5	1.6	1.7	1.8
$\phi(z)$	0.8849	0.9032	0.9192	0.9331	0.9452	0.9550	0.9640

b) Explain briefly the various methods of assessing reliability of a component through accelerated tests.

College Of Engineering, Pune

End Semester Exam- May 2012

F.Y.M.Tech

(IS502-04, PI-504,BI-504)-(Advanced Control Systems)

Day and Date: Thursday, 10 May. 2012 Time: 9 AM-12 PM

Max Marks: 50 Duration: 3 hours

Notes

1. Solve *any five* questions.
2. All questions carry equal marks.

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1. Design a sliding mode control to guarantee invariance for the uncertain system: (10)

$$\dot{x}_1 = x_2$$
$$\dot{x}_2 = x_3$$
$$\dot{x}_3 = u + d$$

where

$$d = \pm x_1^2 x_3 \pm 4 \sin \omega t \pm e^{-t} x_1$$

Assume $\sigma = Sx$ with $S = [8\ 2\ 1]$. Comment on the dynamics in sliding mode and the control effort if the sliding surface was chosen as $S = [800\ \ -4\ 1]$

2. Derive a sliding mode control law for the system $\dot{x} = Ax + Bu + Be(x,t)$, where $e(x,t)$ is bounded but the bound is unknown. Assume the unknown bounding function to be of the form- $\rho(x,t) = c_0 + c_1||x||$. Comment on the choices of bounding function given by the following: (10)

$$\rho(x,t) = c_0 + c_1||x||^2$$

and

$$\rho(x,t) = c_0$$

3. Consider an uncertain system $\dot{x} = Ax + Bu + Be(x,t)$, derive a control to stabilize the system. Use a control $u = u_{eq} + u_n$ with $u_{eq} = -kx^3, \quad k > 0$. Derive u_n using a method of uncertainty estimation. (10)

   Repeat the above problem with $u_{eq} = -(SB)^{-1}SAx - k\sigma$. Comment on the choice of $u_{eq} = -(SB)^{-1}SAx - k\sigma^2$.

4. Derive sliding mode control law for a general nonlinear system acted upon by an external unknown disturbance given by $d = \pm 10 \sin t$. State your assumptions clearly and justify them. The behaviour of the system when it is in sliding mode is to be specified by you. Justify your choice. (10)

5. Design a sliding mode control to guarantee invariance for the uncertain system with respect to the switching surface σ^*: (10)

$$\dot{x}_1 = x_2$$
$$\dot{x}_2 = x_3$$
$$\dot{x}_3 = \pm 4x_1 + u \pm .1\sin(5t)u$$

Assume $\sigma = Sx$ with $S = [10\ 5\ 1]$ and $\sigma^* = \sigma - \sigma(0)\frac{1}{1+\alpha t}$, where α is a positive constant. What will happen if α is negative.

6. Write short notes on: (10)

   a. Liapunov stability criterion

   b. Backstepping

   c. Inertial delay control

   d. Full order sliding

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharastra)

END-SEM EXAMINATION

(IS-502-6) - (Nanotechnology)

Programme: M. Tech. (Institutional Elective) Year: 2011 – 2012

Time Duration: 3 Hours Max. Marks: 50

Instructions

1. Answer all questions.
3. Neat diagrams must be drawn wherever necessary
4. Sharing/exchange of calculators is not allowed.

			Marks
Q. 1		Explain the fabrication of clay *filled polymer matrix nanocomposites*. Discuss in brief the improvement in thermal, mechanical, barrier and fire retardant properties of these nanocomposites.	10
Q. 2	A	Explain the effect of particle sizes on the coercitivity of ferromagnetic materials. Discuss in brief about the four applications of ferrofluids.	5
	B	Write the name of five characterization techniques used for characterizing nanomaterials. Also explain two sample preparation methods for nanomaterials to be examined by transmission electron microscopy (TEM)?	5
Q. 3	A	What is photolithography? Write the resolution limits of any four lithography techniques.	5
		OR	
		Explain the basic principle and the factors affecting resolution of Dip Pen Nanolithography.	
	B	What is carbon nanotube (CNT)? Distinguish between the single walled CNT (SWCNT) and multi-walled CNT (MWCNT). Write any four applications of CNT?	5
Q. 4		Answer **any five** from the following questions; 5×4 marks =	20
	A	3-Dimensional molecular nano-net of Nano-Dry	
	B	Explain (with schematic figure) the photocatalytic effect of TiO_2 in self cleaning glass.	
	C	What are sensors? Explain the sensing response signal versus time for micro- and nano-sensors.	
	D	What is the increase in percentage of the surface atoms when a cube of iron of 1 cm^3 is divided into smaller cubes with an edge of 10 nm? [Given: diameter of iron atom is 0.1 nm]	
	E	What is BET? Explain its principle and application.	
	F	Size effect on energy band gap (of semi-conducting materials), melting point and lattice constants of nanomaterials.	
	G	What is quantum confinement effect? Are "artificial atoms" different than that of quantum dots? Justify your answer.	
	H	Nanotechnology in cosmetics and its challenges	
	I	Percolation threshold phenomena in CNT filled polymer composites	

College of Engineering, Pune

(M.Tech)- (ILOE- Industrial Motion Control)

Date- 4th May 2012
Academic Year: 2011-12

Timing: 3 hrs
Max. Marks: 100

Spring Semester

Instructions:

1. Solve **Any SIX** questions.
2. Draw neat figures wherever necessary.
3. All questions carry equal marks.

Q. 1	A	Explain with the block diagrams for [i]Closed loop speed control with V/F control and slip regulation [ii]Closed loop speed control with torque and flux control.
	B	Derive the stability criteria for electric drives.
Q. 2	A	Obtain the thermal model of electric motor for heating and cooling.
	B	List and explain various classes of motor duty.
Q. 3		Explain direct vector control method for induction motor drive with block diagram and suitable phasor diagram. Give mathematical model for flux vector estimation. Show it in the form of block diagram.
Q. 4		Give the phasor diagram explaining the feed forward vector control. Derive the expression for slip frequency. Give and explain the block diagram for this type of drive.
Q.5	A	Compare BLDC and PMSM drives.
	B	With schematic explain the vector control for line side PWM inverter
Q.6 PS		Compare Direct Torque Control with Vector control and explain how flux and torque are controlled in DTC giving suitable diagrams. **[For PS students]**
Q.6 Non PS		Starting from 3 phase stator winding and 3 phase rotor winding, step by step develop d-q model of induction motor in synchronously rotating reference frame and derive the expression for electromagnetic torque developed by the motor in terms of d-q axes currents and flux linkages. **[Non PS students]**
Q.7		Write Short notes on [Any 3]
	A	Space Vector Modulation
	B	Switched Reluctance Motor
	C	Self control of synchronous motor
	D	Drivers for IGBT's
	E	Slip power recovery schemes

College of Engineering, Pune
End Semester Exam – May 2012
F.Y. M.Tech
(IS-502-8)- (Open Elective -Artificial Intelligence)

Day & Date-
Maximum Marks: 50

Time: -
Duration – 3 hrs.

Instructions:

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Q. 1 A Given following predicates 04

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Female(x) : x is a female
Male(x) : x is a male
Cousin(x,y) : x is a first cousin of y
Represent following statements using these predicates

1. Brothers are siblings
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B Discuss with example non monotonous reasoning. 04

Q. 2 Explain various approaches for mixed mode chaining and their importance. 08

Given the following approach for mixed chaining:

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Use this procedure to deal with the following rule set

1. If F and H then K
2. If E and A then K
3. If E and B then H
4. If A and G then B
5. If B and D then H
6. If G and D then E
7. If A and B then D
8. If A and C then G

Given A and C, determine K.

Q. 3 Discuss how the concept of certainty factor used in an Expert system. 08
Consider the rule R1 given as
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Inputs: x_0, x_1, x_2, with input x_0 held constant at 1. Threshold (t): 0.5
Learning rate (Correction) is to be taken as 0.1 times the iteration error (i.e. desired output- network output) . Let the initial weights w0,w1,w2 be 0.6, -0.2, -0.1 respectively.
Develop the perceptron. Show all iteration steps in details.

Q.5 Discuss various steps of Natural Language Processing with example. 08
A simple Context-free phrase structure grammar fro English:

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8. VP → V
9. VP → V NP
10. N → file | printer
11. PN → Bill
12. PRO → I
13. ADJ → short | long | fast
14. V → printed | created | wan

Develop a parse tree to check if the statement "Bill printed the file" is syntactically correct.
Show all steps clearly. E indicates an empty string.

Q.6 A fuzzy system uses following membership functions 10
Tall (x)= 0 if height < 5 ft
= (height (x) – 5 ft)/ 2 ft if 5 ft <= height(x) <= 7 ft
= 1 otherwise
Old (x)= 0 if age < 18 yr
= (age (x) – 18 yr / 42 yr if 18 yr <= age(x) <= 60 yr
= 1 otherwise
Plot the membership functions.For the following data,

height	3'2"	5'5"	5'9"	5' 10"	6' 1"	7'2"	3"4"
age	65	30	27	32	31	45	4

Compute the sets A, B and C given as
A= x is Tall and x is Old
B= X is Tall or x is Old
C= Not x is Tall