L-1/T-1/CSE **Date : 08/08/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **MATH 145** (Differential Calculus, Integral Calculus and Coordinate Geometry)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE** questions.

1. (a) Let $f(x)=\begin{cases} x^2+x+a, & x\le 0, \\ bx+2, & x>0 \end{cases}$ where a and b are constants. Find all values of a and b for which $f(x)$ is differentiable. **(12)**

   (b) State Leibnitz's theorem. If $y^{\frac{1}{m}}+y^{-\frac{1}{m}}=2x$, then show that

   $$(x^2-1)y_{n+2}+(2n+1)xy_{n+1}+(n^2-m^2)y_n=0.$$ **(12)**

   (c) Evaluate: $\lim_{x\to 0} x\ln(\sin x)$. **(11)**

2. (a) Expand the polynomial $2x^3+7x^2+x-1$ in power of $(x-2)$ and approximate it to five decimal-place accuracy. **(12)**

   (b) Verify Cauchy's mean value theorem for the functions $f(x)=x^2-2x+3$ and $g(x)=x^3-7x^2+26x-5$ in the interval [– 1, 1]. **(11)**

   (c) If $u=f(y-z,z-x,x-y)$ show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. **(12)**

3. (a) If $u=\cos^{-1}\left[\frac{x+y}{\sqrt{x}+\sqrt{y}}\right]$, show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+\frac{1}{2}\cot u=0$. **(11)**

   (b) Find the pedal equation of the parabola $y^2=4ax$ with respect to its focus. **(12)**

   (c) An open box is to be made from a 16-inch by 30-inch piece of cardboard by cutting out squares of equal size from the four corners and bending up the sides. What size should the square be to obtain a box with the largest volume? **(12)**

4. (a) Evaluate $\lim_{n\to\infty}\frac{1}{n}\left[\sin^{2k}\left(\frac{\pi}{2n}\right)+\sin^{2k}\left(\frac{2\pi}{2n}\right)+\sin^{2k}\left(\frac{3\pi}{2n}\right)+\cdots+\sin^{2k}\left(\frac{\pi}{2}\right)\right]$. **(12)**

   (b) $\int_0^{\pi/2}\frac{\sin x\cos x}{a^2\sin^2 x+b^2\cos^2 x}\,dx$; (c) Show that $\int_0^{\pi/2}\frac{dx}{\sqrt{1-\frac{1}{2}\sin^2 x}}=\frac{(\Gamma(1/4))^2}{4\sqrt{\pi}}$. **(11+12)**

Contd P/2

MATH 145

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) Determine the area inside the circle $r = \sin\theta$ and outside the cardioide $r = 1 - \cos\theta$. **(13)**

   (b) Find surface area of the solid generated by revolving the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ about its

   (i) major axis and (ii) minor axis. **(11)**

   (c) Find the volume of the solid generated by revolving about OX enclosed by the parabola $\sqrt{x}+\sqrt{y}=\sqrt{a},\ x=0,\ y=0$ **(11)**

6. (a) Reduce the equation $x^2-6xy+9y^2-2x-3y+1=0$ to is standard form and write down the name of geometrical object represented by the given equation. **(17)**

   (b) Show that the equation $ax^2+2hxy+by^2+2gx+2fy+c=0$ represents two parallel lines if $\frac{a}{h}=\frac{h}{b}=\frac{g}{f}$ and that when these conditions are satisfied, the distance between them is $2\sqrt{\left\{\frac{g^2-ca}{a(a+b)}\right\}}$. **(18)**

7. (a) Find the radical axis and length of the common chord of the circles

   $x^2+y^2+ax+by+c=0,\ x^2+y^2+bx+ay+c=0$. **(12)**

   (b) Find the co-ordinates of limiting points of the circles coaxial with the circles

   $x^2+y^2-6x-6y+4=0$ *and* $x^2+y^2-2x-4y+3=0$. **(12)**

   (c) Prove that if the polar of a point P with respect to the circle $x^2+y^2=37$ touches the circle $(x-3)^2+(y+2)^2=25$ then the locus of P must be a conic. **(11)**

8. (a) Obtain the equation of the asymptotes of the hyperbola **(17)**

   $8xy+3x^2-3y^2+6x+8y+4=0$. Also, find the equation of conjugate hyperbola.

   (b) Two lines at right angles to one another and one of them touches $y^2 = 4a(x + a)$ and the other $y^2 = 4a'(x + a')$; show that the point of intersection of the lines will be on the line $x + a + a' = 0$. **(18)**

L-1/T-1/CSE **Date : 18/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **PHY 109** (Heat and thermodynamic, Electricity and Magnetism, waves and oscillations and Mechanics)

Full Marks : 280 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE** questions.

1. (a) Define the terms **(12)**

(i) Root mean square velocity (r.m.s)

(ii) Mean free path

(iii) Degrees of freedom of a gas

(b) Using Maxwell's Boltzmann distribution law of molecular speeds show that r.m.s. velocity of the molecule is given by

$$v_{r.m.s} = \sqrt{\frac{3KT}{m}}$$

where the symbols have their usual meaning. **(12)**

(c) State the principles of equipartition of energy. Prove that for a monoatomic and a diatomic gases the values of the ratio of the two specific heats (γ) are $5/3$ and $7/5$ respectively. **(22⅔)**

2. (a) Define entropy of a substance. Show that entropy of a system remains constant in a reversible process but increases in an irreversible process. **(20⅔)**

(b) Define and explain four fundamental thermodynamic potentials U, F, H and G, where symbols have their usual meanings. **(14)**

(c) Using thermodynamic potentials, derive the following Maxwell's thermodynamic relations. **(12)**

(i) $\left(\frac{\partial S}{dP}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$

and (ii) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$ where the symbols have their usual meanings.

3. (a) Briefly discuss Kepler's law for planetary motions. **(6⅔)**

(b) With adequate mathematical proof show that the radius vector from the sun to the planet sweeps equal areas in equal time. **(23)**

(c) Derive time independent Schrödinger equation from time dependant Schrödinger equation for stationary state. **(17)**

Contd P/2

PHY 109

4. (a) What do you mean by normalization? Briefly discuss the physical significance of normalization of a wave function. **(7⅔)**

(b) Show that if a wave function is normalized at t = 0, then it would be normalized for any time t. **(20)**

(c) At time t = 0 , a wave function is represented by **(19)**

$$\Psi(x,0)=\begin{cases} A\dfrac{x}{a} & , \ 0 \le x \le a \\ A\dfrac{b-x}{b-a} & , \ a \le x \le b \\ 0 & , \ \text{otherwise} \end{cases}$$

where A, a, and b are constants.

(i) Normalize ψ(x, 0)

(ii) Sketch ψ(x, 0) as a function of position.

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) What is an electric dipole? Derive an expression for electric potential due to a dipole. **(15)**

(b) A charge, Q, is distributed uniformly throughout a nonconducting sphere of radius, R. Show that the potential at a distance, a, from the centre, where $a<R$, is given by

$$V=\frac{Q\left(3R^2-a^2\right)}{8\pi\varepsilon_0 R^3}.$$ **(16)**

(c) State Gauss's law of Electrostatics. Using Gauss's law, calculate the $\vec{E}$ for a uniformly charged solid sphere of radius, a, at a distance, r. from the centre of the sphere. Assume that the amount of charge in the sphere is Q. Consider following cases: **(15⅔)**

(i) $r > a$,

(ii) $r = a$, and

(iii) $r < a$.

6. (a) State and explain Faradays law of electromagnetic induction. A conducting bar moving along two parallel conducting rails with constant velocity, v, in the presence of a uniform magnetic field, B, into the plane, what emf is induced in the bar? **(15)**

(b) What is inductance? Derive expressions for inductance of a long solenoid and a toroid having circular cross-section. **(24)**

(c) Suppose two inductors with equal inductance, L, are connected in parallel. The inductors are separated by a large distance. Calculate the equivalent inductance of the combination. **(7⅔)**

Contd P/3

PHY 109

7. (a) Define the terms free and forced vibrations. **(6)**

   (b) Establish the differential equation for a system executing damped harmonic vibration which is acted upon by an external periodic force and find the solution of the equation. **(20⅔)**

   (c) What is resonance? Discuss the phenomena of sharpness and phase of resonance. How they depend on the damping factor? **(20)**

8. (a) What is a plane progressive wave? Obtain an expression for a plane progressive wave traveling in the positive X-direction. Show that for a one dimensional wave motion the differential equation is,

   $$\frac{d^2y}{dt^2} = v^2 \frac{d^2y}{dx^2},$$ where the symbols have their usual meaning. **(22⅔)**

   (b) Prove that the energy density of a plane progressive wave is independent of both the distance (x) traveled by the wave and time (t). **(14)**

   (c) Consider a plane progressive wave is travelling along a medium and the displacement of a particle in the medium at any instant of time is given by the equation,

   $$y = 15 sin \frac{2\pi}{150}(300t - 15) \text{ cm}$$

   Find (i) the amplitude and phase velocity, (ii) the particle velocity at t = 10 sec, and (iii) the frequency. **(10)**

L-4/T-1/CSE **Date : 30/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **CSE 409** (Computer Graphics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE** questions.

1. (a) Describe the 'Midpoint Ellipse Scan Conversion' algorithm. [Psuedocode is not required] **(20)**

   (b) Derive the equation for 'Phong Illumination Model'. **(9)**

   (c) What is the problem of applying flat shading? When is flat shading applicable? **(6)**

2. (a) Describe the necessary calculations for Gupta-Sproull algorithm for antialised scan conversion of lines. **(20)**

   (b) Why does Cyrus-Beck Parametric Line Clipping algorithm not work with convex polygon? **(8)**

   (c) Write down the properties of 'Weighted area sampling'. **(7)**

3. (a) Let abcdefg and ABCD be the polygon to be clipped and the viewing window, respectively (As shown in the figure 3(a)). Now clip the polygon in the following order of clipping edges. **(10)**

   (i) right clip edge BC

   (ii) bottom clip edge CD

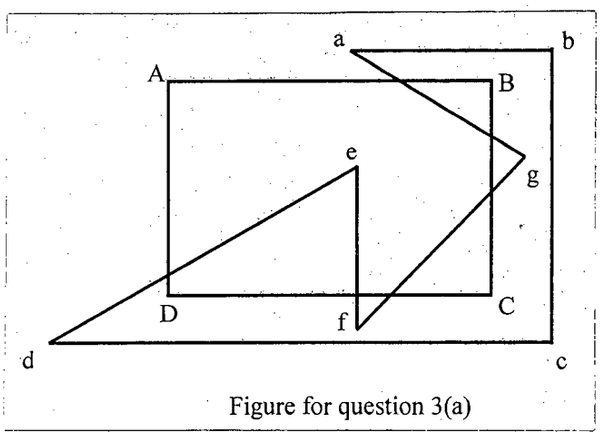

Figure for question 3(a)

(b) Consider the top view of a scene containing four polygons A, B, C and D (solid lines) as shown in figure 3(b). Construct a BSP tree considering A as the root. Write down the order of rendering/drawing the polygons for the given viewing direction. **(25)**

Contd P/2

CSE 409

Contd ... Q. No. 3(b)

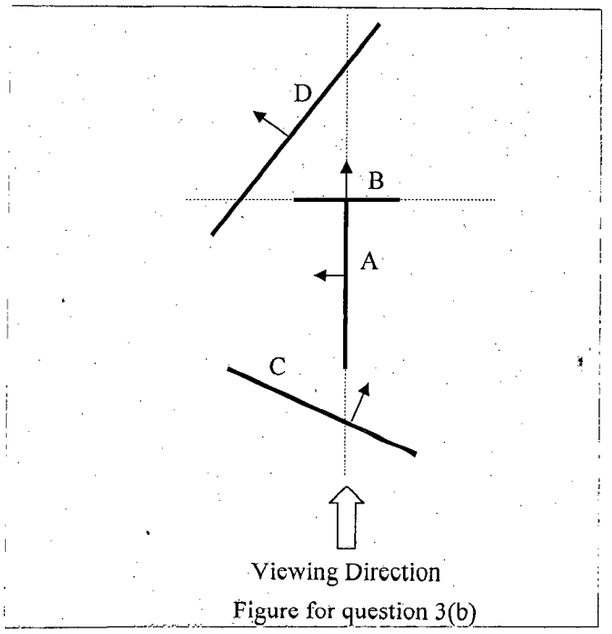

Figure for question 3(b)

4. (a) Draw the initial, 1st generation and 2nd generation Koch Snowflake Curve. **(6)**

   (b) Find the perimeter of the ith generation Koch Snowflake Curve. What will be the perimeter if i tends to infinity? **(6)**

   (c) Find the area of Koch Snowflake Curve of the nth iteration. **(8)**

   (d) Describe the way of simulating roughness by 'Bump Mapping'. **(9)**

   (e) Write the properties of spot light. **(6)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) The vector (2i + 5j + 3k) can be aligned along positive Y-axis by first rotating across Z-axis and then across X-axis. Find the two rotation matrices. **(20)**

   (b) Find the composite transformation matrix that transforms the points A(0,0), B(2, 0), C(2, 2) and D(0, 2) into the points A' (2, 2) B' (0, 2), C'(0, 0) and D'(2, 0). **(15)**

6. (a) A ray originates from the point (2, 8, 3) and has direction parallel to (11i + 37j + 24k). Another ray originates from the point (9, 3, 5) and has direction parallel to (8.25i + 27.75j + 18k). Where do the rays intersect each other? **(20)**

   (b) P(20, 12, 9) and Q(– 12, 4, -3) are two points on a sphere of radius. 17.55. The normal at point P is n and the normal at point Q is $-n$. Without using Cartesian distance formula, find out the distance between P and Q. What is the center of the sphere? **(15)**

Contd P/3

CSE 409

7. (a) Find the perspective projection matrix where the viewing plane is **z = d** and center of projection is at the origin. **(20)**

   (b) In a perspective projection, the projection plane is **x + y = 13** and the center of projection is at **(1, 2, 3)**. Find out where the point **(11, 22, 18)** will be projected. **(15)**

8. (a) Derive the basis matrix of a Hermite curve. **(20)**

   (b) Draw a rough sketch of a Beziere curve that passes through the points (0, 0), (1, 1), (2, 2), and (3, 3). **(15)**

L-1/T-1/CSE **Date : 30/07/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **ME 165** (Basic Mechanical Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Three cables in the Figure for Q1(a) are connected at A, where the force ***P*** is applied as shown. Find the value of ***P*** for which the tension in cable AD is 305 N. **(15)**

   (b) The wire AE is stretched between the corners A and E of a bent plate in the Figure for Q1(b). Knowing that the tension in the wire is 435 N, determine (i) the moment about O of the force exerted by the wire on corner A and (ii) the moment about each of the coordinate axes of the force exerted by the wire on corner A. **(20)**

2. (a) For the frame and loading shown in the Figure for Q2(a), determine the reactions at C and D. **(15)**

   (b) Determine the force in members CD and DF of the truss shown in the Figure for Q2(b) by 'Method of Sections'. State whether each member is in tension or compression. **(20)**

3. (a) Determine the components of all forces acting on member ABC of the frame shown in the Figure for Q3(a). **(15)**

   (b) In the Figure for Q3(b) the coefficients of friction between blocks A and C and the horizontal surfaces are $\mu_s = 0.24$ and $\mu_k = 0.20$. Knowing that $m_A = 5$ kg, $m_B = 10$ kg, and $m_C = 10$ kg, determine (i) the tension in the cord, (ii) the acceleration of each block. **(20)**

4. (a) A plastic film moves over two drums as shown in the Figure for Q4(a). During a 4 s interval the speed of the film is increased uniformly from $v_0 = 1$ m/s to $v_1 = 2$ m/s. Knowing that the film does not slip on the drums, determine (i) the angular acceleration of drum *B*, (ii) the number of revolutions executed by drum *B* during the 4 s interval. **(15)**

   (b) A golfer hits a golf ball with an initial velocity of 50 m/s at an angle of 25° with the horizontal as shown in the Figure for Q4(b). Knowing that the fairway slopes downward at an average angle of 5°, determine the distance d between the golfer and Point *B* where the ball first lands. **(20)**

Contd P/2

ME 165/CSE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) Define Renewable energy and give a few examples. With the help of suitable diagrams or flowcharts write short notes on: **(20)**

   (i) Nuclear energy powered pressurized Water Reactor

   (ii) Geothermal Energy

   (b) Air at 35°C dry bulb temperature and 60% relative humidity flowing at 2 kg/s is mixed with air flowing at 4 kg/s and having conditions of 20°C wet bulb temperature and 30°C dry bulb temperature. Calculate the following properties of the final mixture: (i) Absolute humidity, (ii) Relative humidity, (iii) Dry and wet bulb temperature, (iv) Dew point, (v) Enthalpy. Make sure to attach your psychrometric chart with the details with your answer script. **(15)**

6. (a) Define refrigeration. What do you understand by one ton of refrigeration? With necessary T-s diagrams, explain the difference between Reversed Carnot Cycle and the Vapor Compression Cycle. **(14)**

   (b) Mention few desirable properties of refrigerants. Write down the chemical formulas of (i) R-134, (ii) R-22, (iii) R-718. **(6)**

   (c) A refrigerator uses R-134a as the working fluid and operates on an ideal vapor compression refrigeration cycle between pressures of 0.14 MPa and 0.9 MPa. The mass flow rate of the refrigerant is 0.08 kg/s. Determine: **(15)**

   (i) the rate of heat removed from the refrigerated space

   (ii) the rate of heat rejection to the environment

   (iii) the power input to the compressor

   (iv) the coefficient of performance.

7. (a) Define Internal Combustion Engine. With suitable P-v and T-s diagrams, describe the working principle of a four stroke spark-ignition cycle. Mention two advantages and two disadvantages of four stroke cycle over two stroke cycle. **(20)**

   (b) With the help of a block diagram, describe the fuel supply sub-system of an IC engine. **(10)**

   (c) A V12 engine has a stroke of 86.8 mm and a bore of 87 mm. The clearance volume is 0.05 liter/cylinder. Calculate the displacement volume of the whole engine and the compression ratio. Based on your compression ratio, state whether the engine is a petrol or diesel engine. **(5)**

Contd P/3

ME 165/CSE

8. (a) Define payload. Briefly classify robots according to Japanese Industrial Robot Association (JIRA). **(8)**

(b) Briefly classify robots according to the various robot coordinates. Derive the single matrix, T_{cyl} (r, α, l), which can be used to calculate the positions in cylindrical coordinate system. **(12)**

(c) A point $P(6, 8, 5)^T$ is attached to a frame $(\bar{n}, \bar{o}, \bar{a})$ and is subjected to the following transformations: **(15)**

(i) Translation of [2, – 3, 7].

(ii) Followed by a rotation of 30° about the x axis

(iii) Followed by a translation of [– 1, 4, 3].

Find the co-ordinates of the point relative to the reference frame at the end of the transformations.

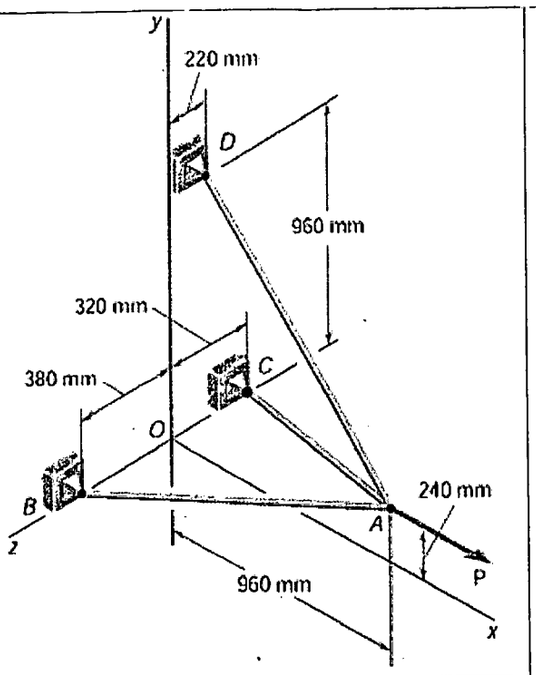

Figure for Q1(a)

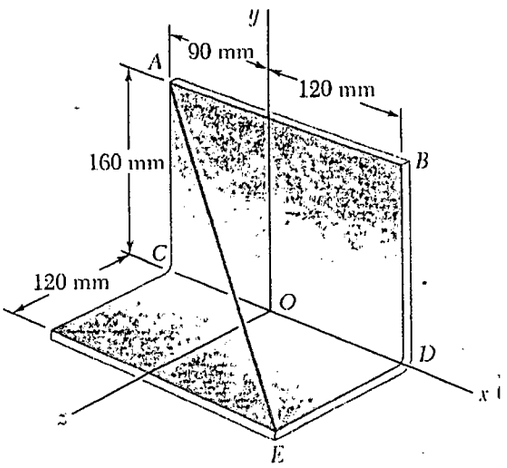

Figure for Q1(b)

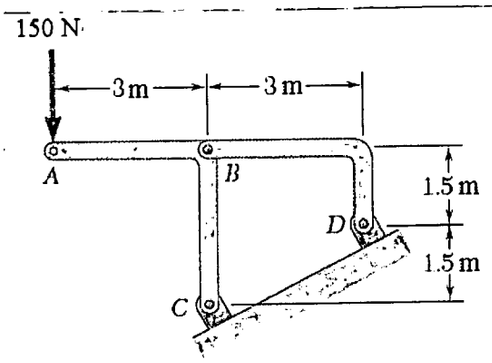

Figure for Q2(a)

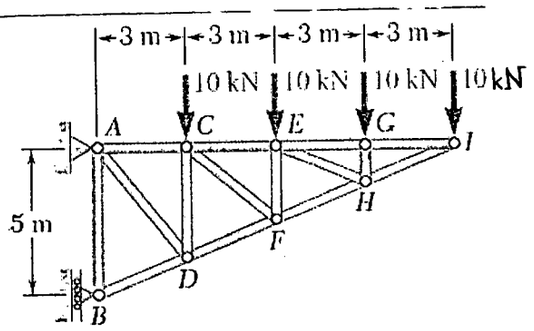

Figure for Q2(b)

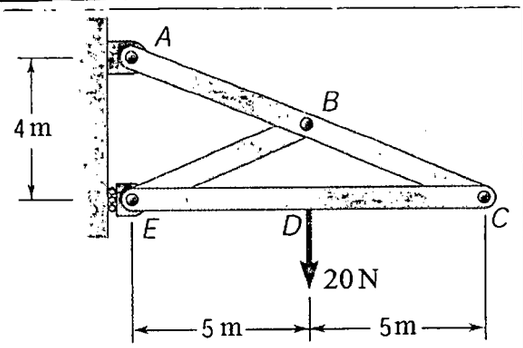

Figure for Q3(a)

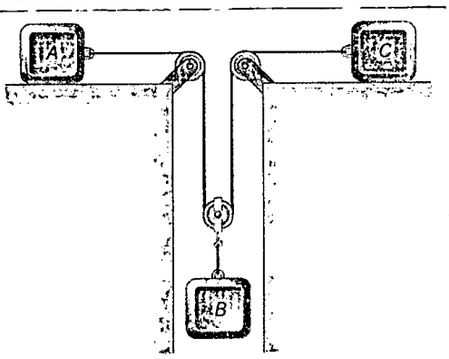

Figure for Q3(b)

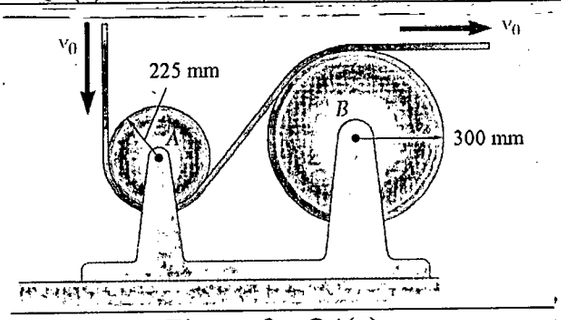

Figure for Q4(a)

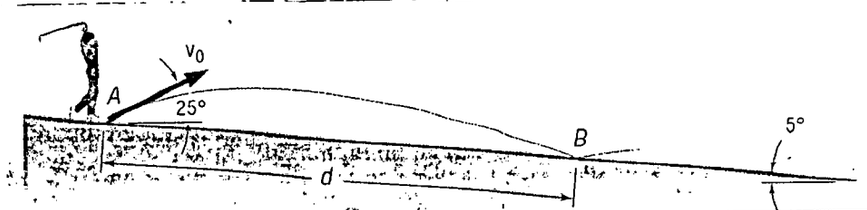

Figure for Q4(b)

Chart for Q.5)b)

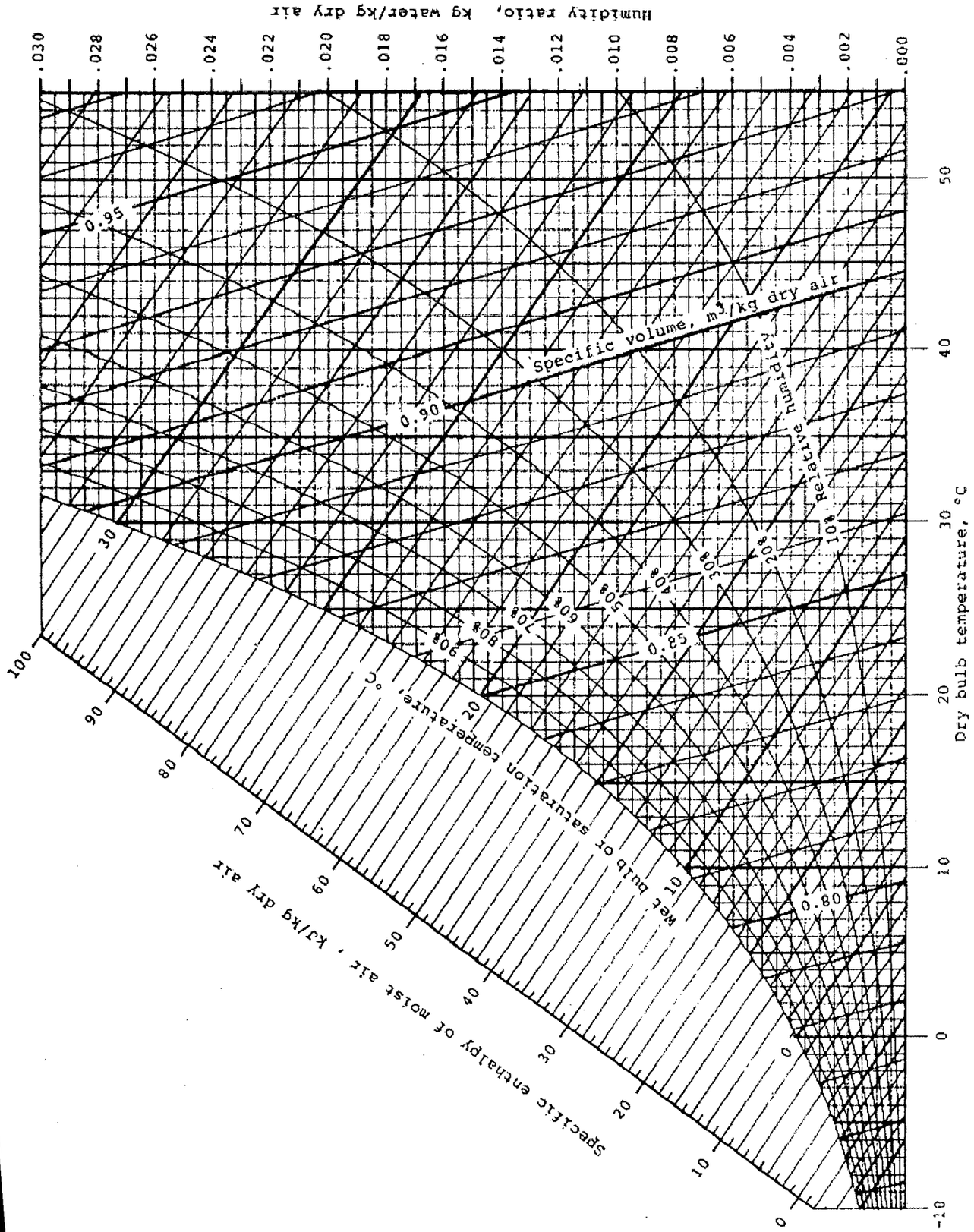

Figure A-9 Psychrometric chart for 1 atm (SI units). *Source:* Z. Zhang and M. B. Pate, "A Methodology for Implementing a Psychrometric Chart in a Computer Graphics System," *ASHRAE Transactions*, Vol. 94, Pt. 1, 1988.

TABLE A-11

Properties of Saturated Refrigerant 134a (Liquid–Vapor): Pressure Table

Pressure Conversions:
1 bar = 0.1 MPa
= 10^2 kPa

Press. bar	Temp. °C	Specific Volume m³/kg: Sat. Liquid $v_f \times 10^3$	Specific Volume m³/kg: Sat. Vapor v_g	Internal Energy kJ/kg: Sat. Liquid u_f	Internal Energy kJ/kg: Sat. Vapor u_g	Enthalpy kJ/kg: Sat. Liquid h_f	Enthalpy kJ/kg: Evap. h_{fg}	Enthalpy kJ/kg: Sat. Vapor h_g	Entropy kJ/kg · K: Sat. Liquid s_f	Entropy kJ/kg · K: Sat. Vapor s_g	Press. bar
0.6	−37.07	0.7097	0.3100	3.41	206.12	3.46	221.27	224.72	0.0147	0.9520	0.6
0.8	−31.21	0.7184	0.2366	10.41	209.46	10.47	217.92	228.39	0.0440	0.9447	0.8
1.0	−26.43	0.7258	0.1917	16.22	212.18	16.29	215.06	231.35	0.0678	0.9395	1.0
1.2	−22.36	0.7323	0.1614	21.23	214.50	21.32	212.54	233.86	0.0879	0.9354	1.2
1.4	−18.80	0.7381	0.1395	25.66	216.52	25.77	210.27	236.04	0.1055	0.9322	1.4
1.6	−15.62	0.7435	0.1229	29.66	218.32	29.78	208.19	237.97	0.1211	0.9295	1.6
1.8	−12.73	0.7485	0.1098	33.31	219.94	33.45	206.26	239.71	0.1352	0.9273	1.8
2.0	−10.09	0.7532	0.0993	36.69	221.43	36.84	204.46	241.30	0.1481	0.9253	2.0
2.4	−5.37	0.7618	0.0834	42.77	224.07	42.95	201.14	244.09	0.1710	0.9222	2.4
2.8	−1.23	0.7697	0.0719	48.18	226.38	48.39	198.13	246.52	0.1911	0.9197	2.8
3.2	2.48	0.7770	0.0632	53.06	228.43	53.31	195.35	248.66	0.2089	0.9177	3.2
3.6	5.84	0.7839	0.0564	57.54	230.28	57.82	192.76	250.58	0.2251	0.9160	3.6
4.0	8.93	0.7904	0.0509	61.69	231.97	62.00	190.32	252.32	0.2399	0.9145	4.0
5.0	15.74	0.8056	0.0409	70.93	235.64	71.33	184.74	256.07	0.2723	0.9117	5.0
6.0	21.58	0.8196	0.0341	78.99	238.74	79.48	179.71	259.19	0.2999	0.9097	6.0
7.0	26.72	0.8328	0.0292	86.19	241.42	86.78	175.07	261.85	0.3242	0.9080	7.0
8.0	31.33	0.8454	0.0255	92.75	243.78	93.42	170.73	264.15	0.3459	0.9066	8.0
9.0	35.53	0.8576	0.0226	98.79	245.88	99.56	166.62	266.18	0.3656	0.9054	9.0
10.0	39.39	0.8695	0.0202	104.42	247.77	105.29	162.68	267.97	0.3838	0.9043	10.0
12.0	46.32	0.8928	0.0166	114.69	251.03	115.76	155.23	270.99	0.4164	0.9023	12.0
14.0	52.43	0.9159	0.0140	123.98	253.74	125.26	148.14	273.40	0.4453	0.9003	14.0
16.0	57.92	0.9392	0.0121	132.52	256.00	134.02	141.31	275.33	0.4714	0.8982	16.0
18.0	62.91	0.9631	0.0105	140.49	257.88	142.22	134.60	276.83	0.4954	0.8959	18.0
20.0	67.49	0.9878	0.0093	148.02	259.41	149.99	127.95	277.94	0.5178	0.8934	20.0
25.0	77.59	1.0562	0.0069	165.48	261.84	168.12	111.06	279.17	0.5687	0.8854	25.0
30.0	86.22	1.1416	0.0053	181.88	262.16	185.30	92.71	278.01	0.6156	0.8735	30.0

ME 165/CSE

=6=

Charts for Q.6(c)

T °C	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg · K	v m³/kg	u kJ/kg	h kJ/kg	s kJ/kg · K
	p = 1.4 bar = 0.14 MPa (T_{sat} = −18.80°C)				p = 1.8 bar = 0.18 MPa (T_{sat} = −12.73°C)			
Sat.	0.13945	216.52	236.04	0.9322	0.10983	219.94	239.71	0.9273
−10	0.14549	223.03	243.40	0.9606	0.11135	222.02	242.06	0.9362
0	0.15219	230.55	251.86	0.9922	0.11678	229.67	250.69	0.9684
10	0.15875	238.21	260.43	1.0230	0.12207	237.44	259.41	0.9998
20	0.16520	246.01	269.13	1.0532	0.12723	245.33	268.23	1.0304
30	0.17155	253.96	277.97	1.0828	0.13230	253.36	277.17	1.0604
40	0.17783	262.06	286.96	1.1120	0.13730	261.53	286.24	1.0898
50	0.18404	270.32	296.09	1.1407	0.14222	269.85	295.45	1.1187
60	0.19020	278.74	305.37	1.1690	0.14710	278.31	304.79	1.1472
70	0.19633	287.32	314.80	1.1969	0.15193	286.93	314.28	1.1753
80	0.20241	296.06	324.39	1.2244	0.15672	295.71	323.92	1.2030
90	0.20846	304.95	334.14	1.2516	0.16148	304.63	333.70	1.2303
100	0.21449	314.01	344.04	1.2785	0.16622	313.72	343.63	1.2573
	p = 8.0 bar = 0.80 MPa (T_{sat} = 31.33°C)				p = 9.0 bar = 0.90 MPa (T_{sat} = 35.53°C)			
Sat.	0.02547	243.78	264.15	0.9066	0.02255	245.88	266.18	0.9054
40	0.02691	252.13	273.66	0.9374	0.02325	250.32	271.25	0.9217
50	0.02846	261.62	284.39	0.9711	0.02472	260.09	282.34	0.9566
60	0.02992	271.04	294.98	1.0034	0.02609	269.72	293.21	0.9897
70	0.03131	280.45	305.50	1.0345	0.02738	279.30	303.94	1.0214
80	0.03264	289.89	316.00	1.0647	0.02861	288.87	314.62	1.0521
90	0.03393	299.37	326.52	1.0940	0.02980	298.46	325.28	1.0819
100	0.03519	308.93	337.08	1.1227	0.03095	308.11	335.96	1.1109
110	0.03642	318.57	347.71	1.1508	0.03207	317.82	346.68	1.1392
120	0.03762	328.31	358.40	1.1784	0.03316	327.62	357.47	1.1670
130	0.03881	338.14	369.19	1.2055	0.03423	337.52	368.33	1.1943
140	0.03997	348.09	380.07	1.2321	0.03529	347.51	379.27	1.2211
150	0.04113	358.15	391.05	1.2584	0.03633	357.61	390.31	1.2475
160	0.04227	368.32	402.14	1.2843	0.03736	367.82	401.44	1.2735
170	0.04340	378.61	413.33	1.3098	0.03838	378.14	412.68	1.2992
180	0.04452	389.02	424.63	1.3351	0.03939	388.57	424.02	1.3245
	p = 14.0 bar = 1.40 MPa (T_{sat} = 52.43°C)				p = 16.0 bar = 1.60 MPa (T_{sat} = 57.92°C)			
Sat.	0.01405	253.74	273.40	0.9003	0.01208	256.00	275.33	0.8982
60	0.01495	262.17	283.10	0.9297	0.01233	258.48	278.20	0.9069
70	0.01603	272.87	295.31	0.9658	0.01340	269.89	291.33	0.9457
80	0.01701	283.29	307.10	0.9997	0.01435	280.78	303.74	0.9813
90	0.01792	293.55	318.63	1.0319	0.01521	291.39	315.72	1.0148
100	0.01878	303.73	330.02	1.0628	0.01601	301.84	327.46	1.0467
110	0.01960	313.88	341.32	1.0927	0.01677	312.20	339.04	1.0773
120	0.02039	324.05	352.59	1.1218	0.01750	322.53	350.53	1.1069
130	0.02115	334.25	363.86	1.1501	0.01820	332.87	361.99	1.1357
140	0.02189	344.50	375.15	1.1777	0.01887	343.24	373.44	1.1638
150	0.02262	354.82	386.49	1.2048	0.01953	353.66	384.91	1.1912
160	0.02333	365.22	397.89	1.2315	0.02017	364.15	396.43	1.2181
170	0.02403	375.71	409.36	1.2576	0.02080	374.71	407.99	1.2445
180	0.02472	386.29	420.90	1.2834	0.02142	385.35	419.62	1.2704
190	0.02541	396.96	432.53	1.3088	0.02203	396.08	431.33	1.2960
200	0.02608	407.73	444.24	1.3338	0.02263	406.90	443.11	1.3212

L-1/T-1/CSE **Date : 03/08/2016**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **CSE 101** (Structured Programming Language)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE** questions.

Please read carefully, some questions might have additional restrictions such as not allowing the use of any functions except the I/O related ones.

1. (a) Write down a code segment that will find and print summation of first n odd numbers (without using any mathematical formula) where n will be input to your program. **(7)**

   (b) Write down a program that will take an integer *n* and a digit *d* as input and will determine how many times the digit of appeared in the number *n*. **(10)**

   (c) Write a short function **lwrcase(ch)** which accepts a character parameter ch and returns the equivalent lowercase letter only if *ch* is an uppercase letter. Otherwise, it returns the same character leaving it unchanged. In the function you can only use switch-case statement to solve the problem (i.,e. **no if-else, no library function**). **(8)**

   (d) Write down a program that will ask the user for values of two integers a and n to compute the result of the following series. You are not allowed to use any library functions except the I/O related ones: **(10)**

$$a^2 - (a-1)^2 + (a-2)^2 - (a-3)^2 + \ldots \pm (a-n)^2$$

2. (a) Write down a function **void remove (int A[], int N, int V)** that searches if V exists in the array A of N integers and removes the last occurrence of V, shifting each following elements to the left and adding a zero at the end of the array. **(12)**

   (b) Using nested loop print a **N × N** size grid where (i) the odd rows will have exactly N number of + signs and the even rows will have exactly N number of – signs, all separated by space, (ii) odd columns will have exactly N number of + signs and even columns will have N number of – signs. N will be input to your program. You do not need to show the whole program just show the loop nesting: **(10)**

Example for 2(i): (suppose N=5)	Example 2(ii): (suppose N=5)
+ + + + +	+ - + - +
- - - - -	+ - + - +
+ + + + +	+ - + - +
- - - - -	+ - + - +
+ + + + +	+ - + - +

Contd P/2

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Contd ... Q. No. 2

(c) An inter is called *k*-smooth if it has no prime factors greater than *k*. The following table gives the first few *k*-smooth numbers for small *k*. Write down a utility function kSmooth (x,k) that will return 1 if x is k-smooth and zero otherwise. **(13)**

k	*k*-smooth numbers
2	1, 2, 4, 8, 16, 32, 64, 128, 256, 512, ...
3	1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, ...
4	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, ...
5	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, ...

3. (a) Create a function **int bitParity (int x)** that takes an integer x as parameter and returns 1 if there is an odd number of 0's in the bit form of x, and 0 otherwise. You must use bitwise operator(s) to solve the problem. **(10)**

(b) A number is called **sparse** if there are no two adjacent 1s in its binary representation. For example 5 (binary representation: 101) is sparse, but 6 (binary representation: 110) is not. **(13)**

(i) Write a utility function isSparse(x) that take a number and returns 1 if x is sparse, and 0 otherwise.

(ii) In the main function take a number n as input and find the smallest sparse number which is greater than or equal to n using the isSparse(x) function.

(c) Create a function **setbit(x,p)** the sets the bit of integer x to 1 at the position p and returns x leaving other bits unchanged. Similarly, create another function **resetbits(x,p)** that resets the bit of x to 0 at the position p and returns. Using the above functions wirte two other functions **setbits(x,p,n)** and **resetbits(x,p,n)** that sets/resets n bits of x starting from position p and returns x leaving other bits unchanged. **(12)**

4. (a) For any positive integer n, the n^{th} number of the following series is given as: **(11)**

$f(n) = 1,$ ***if n = 0***

$f(n) = n \times f(n-1) + n$ **otherwise**

So, the first 6 numbers in the series are:

1, 2, 6, 21, 88, 445

Write down a function **chekinTheSeries(x)** which returns 1 if the parameter x is in the series and 0 otherwise.

checkInTheSeries(1) should return 1,

checkInTheSeries(88) should return 1,

checkInTheSeries(50) should return 0.

Contd P/3

CSE 101

Contd ... Q. No. 4

(b) Consider the following **enigma**(n) function. What will be the output if we execute enigma(4096) from the main function? In one sentence state what the function does? Assume that n > 0. **(7)**

```
int enigma ( int n) {
        if (n = = 1) return 0;
        else return 1+enigma(n/2);
}
```

(c) A year *y* is called leap year if one the following conditions hold: **(7)**

(i) *y* is divisible by 400.

(ii) *y* is divisible by 4 but not divisible by 100

Base on the above rules fill out the following condition marked with "?" symbol to correctly perform the leap year testing:

```
if (   ?   )
        printf("LOL!  Not a leap year");
else
        printf("YAHOO! Leap year");
```

(d) Consider the following program fragment: **(5)**

1. int a, b;
2. int *p, *q;
3. p = &a;
4. q = &b;
5. scanf("%d%d", &a, &b);
6. printf ("a=%d b = %d" , a, b);

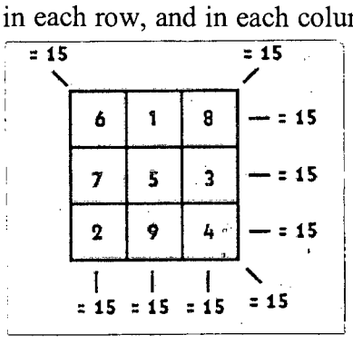
Rewrite statement 5 and 6 using only pointer variable p and q.

(e) Show a program fragment that will repeatedly read 2 numbers, A and B until **both** are 0. For every A and B, print their product. **(5)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE** questions.

5. (a) A magic square is a square matrix of distinct numbers (each number is used only once), where the numbers in each row, and the numbers in each column, and the numbers in each diagonal, all add up to the same number. For example, the following is a magic square where the numbers in each row, and in each column and, in each diagonal add up to 15. **(13)**



Contd P/4

CSE 101

Contd ... Q. No. 5

Write a C function **isMagicSquare(int n, int A[][n])** that checks whether the given square matrix A with n rows is a magic square or not. If the matrix is a magic square, then the function will return 1 otherwise 0. You don't need to write the main function.

(b) Write C function **getMinOfArray** with proper parameters that takes a three dimensional array as parameter and returns the minimum element of this array. You can add more parameter to the function if necessary but you can't declare any global variables. **(7)**

(c) Write a C program that takes a series of integer inputs from the command line and prints the maximum and minimum of them. **(7)**

For example, 5c.exe 3 7 9 – 1 5 7 9 10 will print 10 as maximum and – 1 as minimum.

(d) Write a C function **decToBin (int num)** that returns the binary equivalent of a given integer using **recursion**. **(8)**

6. (a) Write a C preprocessor macro **min3(a, b, c)** that finds out the minimum of a, b, and c. Now write another C preprocessor macro **min4(a, b, c, d)** that finds out the minimum of a, b, c and d using **min3(a, b, c)**. **(7)**

(b) Write a function **isPrime** that takes a variable number of inputs and returns the total number of primes among them. **(10)**

For examples, isPrime (6, 3, 7, 9, 11, 15, 20) will return 3 because (3, 7, 11) are prime and (9, 15, 20) are not. Here the first argument 6 denotes total number of variable arguments.

(c) The Engilish Premier League (EPL) consists of 20 teams. Each team has a name, number of matches played, number of matches won, number of matches drawn, number of matches lost, total goals scored and total goals conceded.

A sample data for 6 team is given below: **(18)**

Name	Played	Win	Draw	Loss	Goals Scored	Goals Conceded
Manchester United	38	23	11	4	78	37
Chelsea	38	21	9	8	69	33
Manchester City	38	17	7	14	59	44
Arsenal	38	19	11	8	72	43
Liverpool	38	16	14	8	55	46
Tottenham Hotspur	38	21	8	9	60	33

Contd P/5

CSE 101

Contd ... Q. No. 6(c)

Now do the following:

(i) Define a C structure for a EPL team and necessary variables to work with 20 EPL teams.

(ii) Write a function **loadFromFile** that loads all the club's information from a file **clubs.txt** to your program.

(iii) Each club will get 3 points for a win, 1 point for a draw and no point for a loss. Based on this point scheme, write a function **printPosition** that prints each team's total point and their position. For example, the output for the above sample of 6 clubs will be as follows:

Name	Total Points	Position
Manchester United	80	1
Chelsea	72	2
Manchester City	58	6
Arsenal	68	4
Tottenham Hotspur	71	3
Liverpool	62	5

(iv) Write a function **storeToFile** that sorts the above information based on ascending order of position and write to a file named **positions.txt**.

Note that, You can add parameters to the functions if necessary but you cannot hard code based on the sample data.

7. (a) Write a C program to find the length of a file in bytes without reading the whole file. **(6)**

(b) Suppose in your C program you are working with an integer. The size of an integer is usually 4 bytes (32 bits). You are interested to find the value of the rightmost bytes (8 bits) How can you do that without using any bitwise operator? **(5)**

(c) Identify the problems of the following code segment: **(6)**

```
1   int main () {
2       int a;
3       int diff;
4       int *q;
5       double *p;
6
7       a = 10;
8       p = &a;
9       *p = 100;
10      *q = 10;
11      p = p + 2;
12      p = p - 2;
13      p = p * 1;
14      p = p / 1;
15      diff = p - q;
16      return 0;
17  }
```

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Contd ... Q. No. 7(c)

You can use the line numbers (in the left) to identify problems if required.

(d) Write C code to implement the following string functions using only points: **(18)**

(i) **char *strncat(char *dest, char *src, size_t n)** – appends the string pointed to by src to the end of the string pointed to by dest up to n characters long.

(ii) **char *strchr(char *str, int c)** – searches for the first occurrence of the character c in the string pointed to by the argument str.

(iii) **int strcmp(char *str1, char *str2)** – compares the string pointed to by str1 to the string pointed to by str2.

(iv) **int strlen(char *str)** – computes the length of the string str up to but not including the terminating null character.

(v) **char *strstr(char *haystack, char *needle)** – finds the first occurrence of the entire string needle which appears in the string haystack.

8. (a) Consider the following function: **(7)**

```
int * f() {
    int a[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
    return a;
}
```

What is the problem with the above function? Describe two different ways how the problem can by solved.

(b) What is the difference between call by value and call by reference? Give examples of both using the variable swap function that interchanges two integer variables given as parameters. **(6)**

(c) Consider the following C library functions **(8)**

void *malloc (int size) – allocates the requested memory and returns a pointer to it. It doesn't initialize the allocated memory.

void *realloc (void *ptr, int size) – attempts to resize the memory pointed to by ptr that was previously allocated using malloc. It is used to fill memory.

void * memset (void * ptr, int value, int num) – sets the first num bytes of memory pointed by ptr to the specified value. It is used to fill memory.

void * memcpy (void * destination, void * source, int num) – copies the values of num bytes from the location pointed to by source directly to the memory pointed by destination. It is used to copy memory.

Now do the following using malloc, memset and memcpy (you can't use realloc)

(i) Write C code to make your own function **void *mymalloc (int size)** that allocates the requested memory and initializes it to zero.

Contd P/7

CSE 101

Contd ... Q. No. 8(c)

(ii) Write C code to make your own function **void * myrealloc (void *oldptr, int oldSize, int newSize)** that implements the realloc library function.

(d) Write two different C programs that dynamically allocate memory for the following two dimensional array using: **(14)**

(i) Array of pointers

(ii) Pointer to pointer

You also need to free the dynamically allocated memory at the end of the program.