

Department of Mathematics		قسم الرياضيات
Faculty of Science		كلية العلوم
الامتحان النهائي للفصل الدراسي الأول للعام الجامعي ٢٠١٤ / ٢٠١٥ طلاب المستوى الرابع شعبة الرياضيات		
اسم المقرر رمزه : ٤٢١ توبولوجي وهندسة تفاضلية (١)	الدرجة الكلية ٥٠ درجة	التاريخ : الخميس ٢٠١٥/١/١٥ الزمن : ساعتان

أجب عن خمسة أسئلة فقط من الأسئلة التالية:

عشر درجات لكل سؤال

١-	(أ) نفرض أن τ توبولوجي على المجموعة غير الخالية X يتكون تحديداً من أربع مجموعات، أي أن $\tau = \{X, \phi, A, B\}$ ، حيث A و B مجموعتان جزئيتان فعليتان من X غير خاليتان وغير متساويتان. ما هي الشروط التي يجب أن تحققها A و B . (خمس درجات)
	(ب) بين أنه إذا كانت U مجموعة مفتوحة و A مجموعة مغلقة في الفضاء التوبولوجي X فإن $U \setminus A$ تكون مجموعة مفتوحة و $A \setminus U$ تكون مجموعة مغلقة في X . (خمس درجات)
٢-	(أ) نفرض أن A مجموعة جزئية غير خالية من الفضاء المتقطع X . أوجد كل من A° و ∂A . (أربع درجات)
	(ب) نفرض أن τ هو التوبولوجي على $\mathbb{N}$ المكون من ϕ وكل المجموعات الجزئية من $\mathbb{N}$ التي على الصورة $E_n = \{n, n+1, n+2, \dots\}$ حيث $n \in \mathbb{N}$. (i) حدد المجموعات الجزئية المغلقة في $(\mathbb{N}, \tau)$. (ii) حدد إغلاق كلا من المجموعتين $\{3, 9, 15, 34\}$ و $\{2, 4, 6, 8, \dots\}$. (iii) حدد المجموعة الجزئية الكثيفة في $\mathbb{N}$. (ست درجات)
٣-	(أ) أوجد التوبولوجي على المجموعة $X = \{a, b, c, d, e\}$ المولد بالتجمع $\{\{a, b, c\}, \{c, d\}, \{d, e\}\}$. (ثلاث درجات)
	(ب) برهن أن دالة الوحدة $i : (X, \tau) \rightarrow (X, \tau^*)$ تكون متصلة إذا وفقط إذا كان $\tau^* \subset \tau$. (أربع درجات)
	(ج) نفرض أن $f : X \rightarrow Y$ دالة متصلة و A فضاء جزئي من X . بين أن دالة التقيد $f _A : A \rightarrow Y$ تكون متصلة. (ثلاث درجات)

أنظر بقية الأسئلة في الخلف

4-	Find the curvature and torsion of the curve $\underline{r} = \{4e^u, e^{2u}, 4u + 5\}$ and prove that the curve is a Helix. Find its angle and the constant direction. If ϕ , ψ and θ are the angles which the curve makes with the coordinate axes, then prove that $\cos \phi + \cos \psi = 1, \cos^2 \theta = 2 \cos \phi \cos \psi$ (10 marks)
5-	Prove that the locus of the centers of osculating sphere at any point on the Helix its angle (θ), also is a Helix its angle is $(\frac{\pi}{2} - \theta)$, and find the necessary and sufficient condition for the curve to be lie on a sphere. (10 marks)
6-	a) Find the intrinsic equations for the curve $\underline{r} = \{2ae^u \cos u, 2ae^u \sin u, ae^u\}$ (5 marks) b) Prove that any regular space curve is completely determined up to its position by its curvature function $\kappa = \kappa(s) > 0$ and its torsion function $\tau = \tau(s)$ (s arc length parameter) (5 marks)

انتهت الأسئلة ————— مع تمنياتنا لكم بالتوفيق
 لجنة الممتحنين : أ.د/ فتحي هشام خضر
 د/ راوية عبد الرحمن حسين



1st Term 2014/2015

Final Exam for Level 4 Faculty of Science

Subject: Computer Graphics MC461

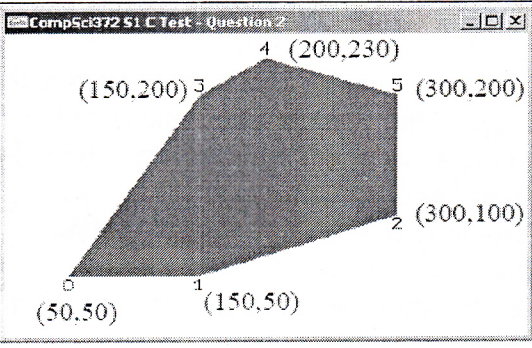
Time: 2 Hours

Mathematics Dept.

Faculty of Science

Assiut University

Answer the following questions (50 marks)

Q. 1	Explain clearly what each function call does in the following main program. <pre>int main(int argc, char **argv) { glutInit(&argc, argv); glutInitDisplayMode(GLUT_DOUBLE GLUT_RGBA); glutCreateWindow("Example"); glutReshapeFunc(reshape); glutDisplayFunc(display); init(); glutMainLoop(); }</pre>	10 marks
Q. 2	In this question you have to draw the 2D object shown on the right. The vertices 0 to 5 of the object and the corresponding coordinates are shown in the image on the right. A. Complete the code fragment below so that it defines a global array containing the six 2D vertices of the above shape: <pre>const int numVertices=6; const float v[numVertices][2] =</pre> B. Complete the display function below so that it draws the shape defined by these six vertices using the GL_QUADS mode and the glVertex2fv command. The vertex numbers in the resulting image (shown above) have been inserted afterwards for clarity and you don't have to draw them. <pre>void display(void) { // clear all pixels in frame buffer glClear(GL_COLOR_BUFFER_BIT); glColor3f(1.0, 0.1, 0.2); // reddish colour glBegin(GL_QUADS); glEnd(); glFlush(); }</pre> 	10 marks
Q. 3	What are the differences between: - the function glOrtho() and the function gluPerspective() Double-buffering and depth buffer	10 marks

Please see next page

Q. 4	Fill in the blanks in each of the following statements a) For the following camera set: <code>gluLookAt (0.0, 0.0, 0.0, 0.0, 0.0, -1.0, 0.0, 1.0, 0.0);</code> up direction is: camera position is:..... point of interest is: b) The command <code>glMatrixMode(GL_MODELVIEW)</code> selects a which handles both modelling operations and c) The is a region of memory sufficiently large to hold all pixels of the display. d) In this course we use three libraries for writing OpenGL programs: GL, GLU and	10 marks
Q. 5	Complete the display method on the next page so that it draws the scene shown in the image below. The axes and their labels have been added for clarity and you don't have to draw them. The scene consists of a cube centred at the origin with a side length of 2 units. Inserted into the front face and right hand side face of the cube is a torus with an inner radius of 0.2 units and an outer radius of 0.8 units such that exactly half of each torus lies outside the cube. You may use the following functions: <pre>void myCube(); draws a cube centred at the origin with a side length of 2. void myTorus(); draws a torus centred at the origin with an inner radius of 0.2 an outer radius of 0.8 and its axis aligned with the z-axis. void display(void) { glMatrixMode(GL_MODELVIEW); // Set the view matrix ... glLoadIdentity(); // ... to identity. gluLookAt(0,0,8, 0,0,0, 0,1,0); // camera is on the z-axis glClear(GL_COLOR_BUFFER_BIT GL_DEPTH_BUFFER_BIT); // set material properties glMaterialfv(GL_FRONT, GL_SPECULAR, mat_specular); glMaterialfv(GL_FRONT, GL_AMBIENT_AND_DIFFUSE, mat_ambient_and_diffuse); glMaterialfv(GL_FRONT, GL_SHININESS, mat_shininess); // Draw the cube and the tori glutSwapBuffers(); }</pre>	10 marks

Best Wishes, Dr. Hanaa A. Sayed



Important remarks

- Number of Pages: 4 questions/answers
- Number of Questions: 4

PLEASE, ANSWER THE FOLLOWING QUESTIONS

Question 1:

(13 Points)

Complete the following statements from the given table: Write only the corresponding number(s)
(0.5 point each space)

1	Instruction count	9	Performance	17	Underflow	25	Memory	33	global variables
2	CPI	10	0 to 64K-1	18	Zero	26	Registers	34	local variables
3	Clock rate	11	0 to 256K-1	19	One	27	J	35	Temporary registers
4	add \$ra,zero,\$pc+4	12	0 to 64M-1	20	-ve Exponent	28	Jal	36	Saved registers
5	Simplicity	13	0 to 256M-1	21	+ve Exponent	29	Least	37	Single cycle
6	Regularity	14	R-format	22	Fraction	30	Most	38	Multi cycle
7	0x00000000	15	I-format	23	Execution time	31	Stall	39	Pipelined
8	0x80000000	16	Overflow	24	Throughput	32	Hazard	40	Unknown

- Adding more processors to a computer system may affect _____.
- In MIPS, _____ can be overwritten by the callee.
- Optimized compilers, usually, use _____ for most frequently used variables.
- Using a _____ datapath, every instruction class operates in different clock cycles. While using a _____ datapath, instructions operate in same clock cycles, but they are overlapped in execution.
- Pipeline _____ is a situation that prevents starting the next pipelined instruction in the next cycle.
- Procedure frame is the segment of the stack containing a procedure's _____.
- The MIPS instruction _____ can be used to copy the content of \$pc+4 to \$ra.
- _____ is the range of addresses in words for j and jal instructions in MIPS while _____ is the range of addresses in bytes for conditional branches in MIPS.
- In the floating point format, overflow occurs when a _____ becomes too large to fit in its field.
- Arithmetic MIPS instructions, which have a constant operand, are _____ instructions.
- _____ occurs when subtracting +ve from -ve integer operands if result sign is _____.
- In the floating point format, size of _____ field affects the represented number's precision.
- In MIPS assembly code, the caller passes the 6th argument to the callee in _____.
- _____ defines total work done per unit time.
- If \$t1 = -2 and \$t2 = 10, after MIPS instruction stlu \$t0, \$t1, \$t2: \$t0 = _____.
- _____ of an ISA makes HW implementation simple, which enables higher _____ at lower cost.
- In MIPS data transfer instructions, LSB is transferred to _____ address of a word.
- Algorithm affects _____, compiler affects _____ and ISA affects _____ in the CPU performance equation.
- In 32-bit IEEE Std. 754 floating point format, _____ represent(s) zero.
- A MIPS instructions, which have a constant operand, are _____ instructions.

(2)

Question 2:

(10 Points).

- a. Consider the shown MIPS code fragment. Assume the code segment starts at memory address 20000 as shown in the left column of the table. (All the given numbers are decimal numbers). Complete the table with the corresponding machine code values. (4 points)

```

add $t0, $t1, $s6
Loop: bne $t2, $s4, Exit
      sll $s3, $t0, 2
      lw  $t0, 10($t1)
      j   Loop
Exit: addi $s2, $s3, 100

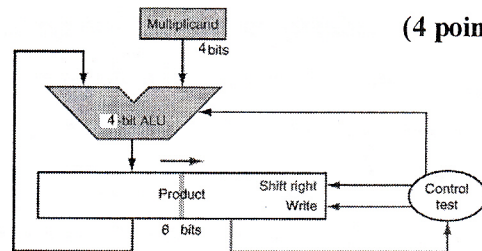
```

20000					32
20004	5		20		
20008					0
20012	35		8		
20016	2				
20020	8				

- b. The memory location, which its address is stored in \$t1, contains 0x12345678 and the memory location, which its address is stored in \$t2, contains 0xFFFFFFFF. What is the content of the memory location referenced by \$t2 after each of the following codes? (2 points)

lb \$t0, 0(\$t1)	lb \$t0, 0(\$t1)
sw \$t0, 0(\$t2)	sb \$t0, 0(\$t2)
Results:	Results:

- c. Using the optimized Multiplier circuit shown in the figure, find the product 0011x0010. Illustrate the values of Product and Multiplicand registers for each step. You need to provide the DESCRIPTION of the step being performed (shift left, shift right, add, no add). (4 points)



Question 3:

(14 Points)

a) Write a MIPS procedure for :

`float inc(float n){ return n+1;}` //float n is assigned to \$f0.

(4 points)

b) Consider four three datapath implementations I1: Single cycle with fixed length, I2: Multi cycle and I3: pipelined. Assume that the operation times for the major used functional units are Memory access 200ps, ALU operation 100ps, and Register file access 50ps, ignoring all other units' delay. Given a program have 10^6 instructions with the following mix 15% store, 30%load, 50% arithmetic and 5% branch. Answer the following questions:

1. What is the CPI for I2?

(3 points)

2. Compare between the performance of I1 and I3.

(3 points)

I1 Execution Time =

I3 Execution Time =

The performance ratio: $\frac{I3Performance}{I1Performance} = \text{_____} \approx$

c) Given the following bit pattern: 0x01E04010:

(2 points each)

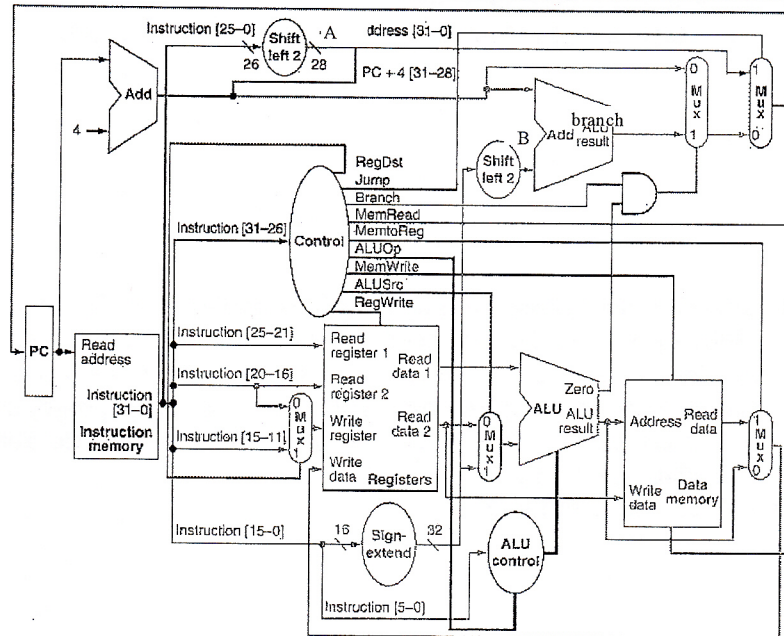
1. What does it represent, assuming it is a single precision floating-point number?

2. Write MIPS instruction(s) to copy it to \$t0

Question 4:

(13 Points)

- I. The shown figure illustrates a complete simple datapath, which combines the resources required by different MIPS instruction classes. Answer the following questions:



1. add \$1,\$2,\$3

(3 points)

Write the values (or NONE) supplied to the register file	Read register 1 ≡	Read register 2 ≡	Write register ≡
What are the resources that perform a useful function?			

2. lw \$1,2(\$3)

(3 points)

Write the values (or NONE) supplied to the register file	Read register 1 ≡	Read register 2 ≡	Write register ≡
What are the resources that perform a useful function?			

3. beq \$1,\$2,\$3

(3 points)

Write the values (or NONE) supplied to the register file	Read register 1 ≡	Read register 2 ≡	Write register ≡
What are the resources that perform a useful function?			

4. One class of instructions missing, in the given implementation, is that of the jump instruction. Extend the datapath and control of the given implementation to include the jump instruction. Describe how to set any new control lines.

(4 points)

END of Questions

Best wishes, Dr. Mostafa Abdelrahman + Committee



First Semester Final Examination

Subject : Course No 411 M

Name of Course : Functional Analysis

Students : Fourth Year Math.

Answer five questions from the following:

1-..... (10 degrees)
(a) If d_1 and d_2 metrics, check if the following functions are also metrics:

(i) $\min \{ d_1, d_2 \}$

(ii) $d_1 \cdot d_2$

(5 Degrees)

(b) Let $0 < p < 1$ and $\|x\|_p = \left(\sum_{i=1}^n |x_i|^p \right)^{1/p}$, $x \in \mathbb{R}^n$. Show that $\|x\|_p$ is not a norm on $\mathbb{R}^n$ if $n \geq 2$

(5 Degrees)

2-..... (10 Degrees)

(a) Let X and Y be Banach spaces. Show that $X \times Y$ also a Banach space

(5 Degrees)

(b) Let $C[0,1]$ be the space of all continuous functions on $[0,1]$. The metric d on $C([0,1])$ is defined by :

$$d(f, g) = \left(\int_0^1 |f(x) - g(x)|^2 dx \right)^{1/2}, \quad f, g \in C[0,1].$$

Show that by an example $(C[0,1], d)$ is not complete metric space.

(5 Degrees)

3-..... (10 Degrees)

(a) Let ℓ^p , $1 \leq p \leq \infty$ denote the set of all infinite sequences $x = (x_1, x_2, x_3, \dots)$ of Complex numbers for which the series $\sum_{n=1}^{\infty} |x_n|^p < \infty$ with the norm:

$$\|x\|_p = \left(\sum_{i=1}^{\infty} |x_i|^p \right)^{1/p}$$

Prove that ℓ^p is a Banach space.

(5 Degrees)

(b) Show that every finite dimensional subspace Y of a normed space X is complete.

(5 Degrees)

P.T.O

(2)

4-..... (10 Degrees)

- (a) Let X and Y be two normed spaces, $B(X,Y)$ be the space of all linear bounded operators T on X into Y with the norm :

$$\|T\| = \sup_{\|x\|=1} \|Tx\|$$

Show that $B(X,Y)$ is a Banach space if Y is a Banach space. (5 Degrees)

- (b) If $h \in C(a,b)$ and $b - a < 1$. Show that the mapping $T : C(a,b) \rightarrow C(a,b)$ defined by :

$$T(g)(x) = h(x) + \int_a^x g(t) dt, \quad x \in (a,b), \quad g \in C(a,b),$$

is a contraction mapping. (5 Degrees)

5-..... (10 Degrees)

- (a) State and prove a Banach fixed point theorem. (5 Degrees)

- (b) For fixed $a \in \mathbb{R}$, we define the mapping $T : \mathbb{R} \setminus \{-1\} \rightarrow \mathbb{R} : f(x) = 1 + \frac{a}{1+x}$ (5 Degrees)

- (i) For which values of a does the mapping have a fixed point ?
(ii) For which values of a is the mapping have a contractive mapping

6-..... (10 Degrees)

- (a) Using Banach fixed point theorem to show that the integral equation

$$f(t) = \int_0^1 e^{\lambda t} \cos(\lambda f(s)) ds, \quad 0 \leq t \leq 1, \quad 0 \leq \lambda \leq 1,$$

has a unique solution. (5 Degrees)

- (b) Let $T : C[0,1] \rightarrow C[0,1]$ be a mapping defined by :

$$(Tf)(t) = e^t f(t), \quad f \in C[0,1], \quad 0 \leq t \leq 1.$$

Prove that $T \in B(C[0,1], C[0,1])$ and compute $\|T\|$. (5 Degrees).

Prof. Dr.R.A.Rashwan

Good Luck



1st Term 2014/2015

✓ (10)

Final Exam
MC457 Theory of Computation
2 Hours – 50 Points

Mathematics Dept.
Faculty of Science
Assiut University

Answer the following questions: (12.5 points for each)

Q1.

- a) Write a context-free grammars rule for mathematics expression containing $\{a, +, \times, (,)\}$.
- b) Prove the statement “The class of regular languages is closed under the union operation”.
- c) Convert the regular expression $(ab \cup a)^*$ to a finite machine.

Q2.

- a) Design a finite machine that accepts only the string 0001.
- b) Define formally generalized nondeterministic finite automaton.
- c) Prove this statement “If a language is described by a regular expression, then it is regular”.

Q3.

- a) Give an example of nonlinear regular expression, and explain the machines that can solve it.
- b) What do the next regular expressions mean:
 - a. $\Sigma^*1\Sigma^*$
 - b. $(\Sigma\Sigma)^*$
- c) Design Push-Down automata to accept the language

$$\{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } (i = j \text{ or } i = k)\}$$

Q4.

- a) Define formally, the **Turing Machine** and how it can be computed.
- b) Design a Turing Machine that accepts the language $\{0^{2^n} \mid n \geq 0\}$. Apply your designed machine for the string **000**.

Best Wishes

Assiut University
Faculty of Science
Mathematics Department
Term Exam

Computer Security
Fourth Level (MC453)
Time: 2 hours
January 2015 (2014-2015)

Answer the following questions: (50 Marks)

Question 1: Answer the following questions: (10 Marks)

- 1-Discuss the term CIA Triad?
- 2-What are the general means of authenticating a user's identity?

Question 2: Answer the following questions: (10 Marks)

- 1-Malware are mainly classified into two broadly categories. What are these categories? Discuss another method for malware classification?
- 2-Explain the virus phases?

Question 3: Answer the following questions: (10 Marks)

- 1-Define DoS attack & Distributed Denial of Service DDoS Attacks? Support your answer with a diagram?
- 2-Explain Reflection Attacks? What is the basic defense against these attacks?

Question 4: Answer the following questions: (10 Marks)

- 1-What are the main classes of intruders? Explain each one of them?
- 2-Define the term Intrusion Detection? Explain the types of (IDSs)?

Question 5: Answer the following questions: (10 Marks)

- 1-What are Firewall capabilities & limits?
- 2-Explain Packet Filtering Firewall?

Dr. Tarik M. A. Ibrahim



أجب عن خمسة من الأسئلة التالية:

1- For small ε determine three terms in the expansions of

i) $\frac{\ln(1+\varepsilon)}{1-\varepsilon}$ (ii) $\ln \frac{1+2\varepsilon-\varepsilon^2}{\sqrt{1+2\varepsilon}}$. (iii) $\cos(\sqrt{1-\varepsilon}t)$. (10 marks)

2- Arrange the following in descending order for small ε

$\ln(1+\varepsilon)$, $\frac{1-\cos\varepsilon}{1+\cos\varepsilon}$, $\sqrt{\varepsilon(1+\varepsilon)}$, $\frac{\sqrt{\varepsilon}}{1-\cos\varepsilon}$, $\ln\left[1+\frac{\ln(1+2\varepsilon)}{\varepsilon(1-2\varepsilon)}\right]$, $e^{-\cosh\left(\frac{1}{\varepsilon}\right)}$. (10 marks)

3- Show that as $x \rightarrow \infty$

(i) $\int_0^\infty \frac{e^{-xt}}{t+1} dt \cong \frac{1}{x} - \frac{1}{x^2} + \frac{2}{x^3} - \frac{6}{x^4}$,
(ii) $\int_x^\infty \frac{e^{-t}}{t^2} dt \cong \frac{e^{-x}}{x^2} \left[1 - \frac{2}{x} + \frac{6}{x^2}\right]$. (10 marks)

4- For small ε determine two terms in the expansion of each root of the following equations

(i) $u^3 - (3+\varepsilon)u - 2 + \varepsilon = 0$,
(ii) $\varepsilon(u^5 + u^4 - 2u^3) - 4u^2 + 4u - 1 = 0$. (10 marks)

5- Consider the problem

$$\varepsilon \frac{d^2 y}{dx^2} + \frac{dy}{dx} + y = 2,$$

$$y(0) = \alpha, \quad y(1) = \beta,$$

- (i) Determine the exact solution.
(ii) Use the method of multiple scales to determine a first-order uniform expansion. Compare your answer with the exact solution. (10 marks)

6- Determine a first-order uniform expansion for

$$\varepsilon \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + xy = 0,$$

$$y(0) = \alpha, \quad y(1) = \beta.$$

(10 marks)

انتهت الأسئلة

إ.د/عبدالحى عزوز إ.د/محمد عزب



1st Term 2014/2015

Final Exam for Level 4

Subject: Software Design and Engineering

Course No. MC467

Time: 2 Hours

Mathematics Dept.

Faculty of Science

Assiut University

Answer the following questions (50 marks)

Q1	a) What is the IEEE definition for software engineering ? b) What are the framework activities ? c) Describe the incremental model for software development and list three of its advantages for software development.	15 marks
Q2	Show the traceability matrix used in mapping between system requirements to use cases based on the following system requirements to use cases tables and show what is the purpose of traceability matrix System requirements REQ1: Keep door locked and auto-lock REQ2: Lock when "LOCK" pressed REQ3: Unlock when valid key provided REQ4: Allow mistakes but prevent dictionary attacks REQ5: Maintain a history log REQ6: Adding/removing users at runtime REQ7: Configuring the device activation preferences REQ8: Inspecting the access history REQ9: Filing inquiries Use cases UC1: Unlock UC2: Lock UC3: AddUser UC4: RemoveUser UC5: InspectAccessHistory UC6: SetDevicePrefs UC7: AuthenticateUser UC8: Login	10 marks
Q3	Show system sequence diagram and domain model for Unlock Use case from the previous tables	15 marks
Q4	Complete: a) _____ defines the actual work to be done to accomplish the objectives of a software engineering action. b) _____ requirements define factors, such as I/O formats, storage structure, computational capabilities, timing, and synchronization. c) _____ is a description of how a user will use the system-to-be to accomplish business goals d) Requirements Engineering Components are _____, _____ and _____. e) _____ is a particular choice of input data to be used in testing a program	10 marks

Best Wishes, Dr. Hanaa A. Sayed

Answer only five of the following questions:

1- a) Let E be a class of sets. **Prove that** there exists a unique ring $\mathfrak{R}_0$ such that $\mathfrak{R}_0 \supset E$ such that if $\mathfrak{R}_0$ is any other ring containing E then $\mathfrak{R}_0 \subset \mathfrak{R}$. (10 marks)

b) If E is a countable class of sets, **show that** $\mathfrak{R}(E)$ is countable. (10 marks)

2- a) **State and prove** Egoroff's Theorem. (12 marks)

b) If f is an integrable function, **prove that**

$$\left| \int f d\mu \right| \leq \int |f| d\mu. \quad (8 \text{ marks})$$

3- a) **What** are the hypotheses to impose on a ring to be an algebra. (10 marks)

b) **Verify that:** every set in $S(\mathfrak{R})$ is μ^* -measurable. (10 marks)

4- a) **Why** does almost uniform convergence imply convergence in measure. (10 marks)

b) **Is** the set function μ countably additive on P . (10 marks)

5- a) **Illustrate that** every countable set is a Borel set of measure zero. (7 marks)

b) If $\{E_1, E_2, \dots, E_n\}$ is a finite, disjoint class of sets in P , each contained in a given set E_0 in P , **conclude that**

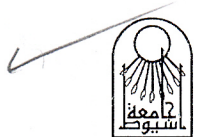
$$\sum_{i=1}^n \mu(E_i) \leq \mu(E_0). \quad (13 \text{ marks})$$

6- a) Let μ be a measure on a σ -ring. **Deduce that** the class of all sets of σ -finite measure is a σ -ring. (8 marks)

b) Let μ be a measure on a ring $\mathfrak{R}$. Assume that $\{E_n\}$ is an increasing (resp., a decreasing) sequence of sets in $\mathfrak{R}$ for which $\lim_{n \rightarrow \infty} E_n \in \mathfrak{R}$ (resp., of which at least one has finite measure and for which $\lim_{n \rightarrow \infty} E_n \in \mathfrak{R}$). **Show that**

$$\mu\left(\lim_{n \rightarrow \infty} E_n\right) = \lim_{n \rightarrow \infty} \mu(E_n). \quad (12 \text{ marks})$$

Good Luck

Department of Mathematics		قسم الرياضيات
Faculty of Science		كلية العلوم
امتحان نهائي الفصل الدراسي الثاني ٢٠١٤/٢٠١٥ م		
الفرقة : التاريخ :		
الزمن : ساعتان	شعبة : رياضيات رقم المقرر ورمزه : ٤٣١ ر	اسم المقرر : هيدروديناميكا ومرونة (١) الدرجة الكلية : ٥٠ درجة

أجب عن أربعة فقط مما يأتي :

١- (أ) سطح جسم مرن مجهود العمودي عليه يصنع جيوب تمام اتجاه مع محاور الاحداثيات . استنتج العلاقة التي تربط بين مركبات الاجهادات المطبقة علي هذا السطح ومركبات الاجهادات الداخلية عند نقطة ، ومن ثم احسب مركبة الاجهاد العمودي والمماسي علي هذا السطح (6.5 درجة)

ب (عند نقطة في جسم مرن مجهود وجد ان حالة الاجهاد هي

$$\sigma_x = \sigma_y = \sigma_z = \sigma_{yz} = \sigma, \sigma_{xy} = 75 \text{ Mpa}, \sigma_{xz} = 0$$

عين سطح كوشي للاجهاد في هذه الحالة . (6 درجات)

١- (أ) استنتج مركبات الانفعال بدلالة مركبات الاجهاد ومن ثم اوجد قانون هوك للانفعال الحجمي (6.5 درجة)

٢- (ب) اذا كان E هو معامل ينح ، v معامل بواسون ، G معامل المرونة علي القص فاثبت ان

$$G = E/2(1 + v)$$

٣- (أ) احسب مركبات متجه الازاحة u اذا علم ان مركبات الافعال هي :

$$e_x = ay, e_y = e_z = by, e_{xy} = e_{yz} = e_{xz} = 0 \text{ حيث } a, b \text{ ثوابت}$$

ب) منبعان شدة كل منها m وضعا عند النقطتين (a, 0), (-a, 0) ومصب شدته 2m وضع عند نقطة الاصل . اوجد معادلات خطوط الانسياب . (6.5 درجة)

٤- (أ) انسياب منتظم له السرعة U عند اللانهاية في الاتجاه الموجب لمحور x يمر علي اسطوانة دائرية ثابتة نصف قطرها a ، احسب الضغط المؤثر علي الاسطوانة والعزم حولها . (6 درجات)

ب) استخدم التحويل $\zeta = z^3$ لنقل المنطقة في المستوي z المحددة بالاقواس الدائرية $r=a, r=b$ وانصاف الاقطار $\theta=0, \theta=60^\circ$. (6.5 درجة)

٥- (أ) اكتب معادلات حركة مائع لزج غير قابل للتضاغط ، ثم ادرس حركة مستوي لانهاية الطول تحرك فجأة في مستواه بسرعة ثابتة في مائع لزج غير قابل للتضاغط . (6.5 درجة)

ب) استنتج معادلات الطبقة الجدارية في بعدين لمائع لزج غير قابل للتضاغط يمر علي سطح مستوي . (6 درجات)



Answer the Following Questions:

Question One: (10 Points)

Fill spaces for **ONLY 10 items** by appropriate terminologies:

1. In the ____ neural network, the network has no loops.
2. The activation of a neuron is transformed through a ____ to generate the output of the neuron.
3. The new weight w_{k+1} in α -LMS algorithm is computed as ____.
4. In threshold logic neurons, inputs satisfying the ____ function yield zero activation.
5. In Back-propagation networks, w_{ih} refers to the weight between the hidden layer and the ____ layer.
6. The ____ rule alters the weights of a network using a linear error measure to reduce the error in the output.
7. The signal state space of the ____ function is $\{-1, 1\}$.
8. When convex hulls have no overlaps, the pattern sets become ____.
9. When neurons in a single field connect back onto themselves the resulting network is called a/an ____ neural network.
10. **XOR** problem can be solved by combining the ____ and **NAND** neurons using a logical **AND**.
11. For a p -dimensional field of neurons with the binary threshold signal function, the signal state space is ____.

Question Two: (10 Points)

A. Define **ONLY 5 items** of the following: use figures and Math equations if possible: (5 points)

1. Convex sets
2. Gaussian signal function.
3. Heteroassociators neural network.
4. Linear threshold signal function.
5. Sigmoid signal function.
6. Two-class data classification problem

- B. Solve the logical **NOR** classification problem geometrically to find an appropriate weight vector and the corresponding discriminate function. (5 points)

Question Three: (10 Points)

Use the *Perceptron Learning Algorithm* to design a weight vector of a single TLN to correctly classify the set of patterns of the function $F(X1, X2)$. Explain your answer step by step. Use $\eta = 1$ and $W1 = 0$. (10 points)

$X1$	$X2$	F
1	1	1
0	1	0

Question Four: (10 Points)

Suppose that an artificial feedforward neural network with one hidden layer has been used to approximate a function with the training vector (X_k, D_k) , $k = 1, 2, \dots, q$, $X_k \in R^n$, and $D_k \in R^p$ using the back-propagation technique. Answer the following questions, support your answers with figures if possible:

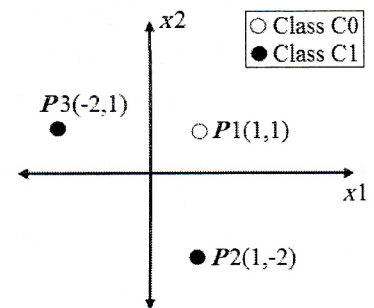
1. Explain the main properties and advantages of the feedforward neural networks. (2 points)
2. Draw the structure of the proposed network. (2 points)
3. State number of neurons and their index range in each layer for the network. (1.5 points)
4. Write the signal function used for each layer. (1.5 points)
5. Compute the activation values and the signal values for neurons in each layer. (3 points)

Question Five: (10 Points)

- A. Write a flowchart that explain **ONLY ONE** of the following algorithms. (5 points)

1. The *Perceptron Learning Algorithm*.
2. The *Pocket Algorithm*.

- B. Suppose that you have three patterns $P1$, $P2$ and $P3$ from two classes $C0$ and $C1$, as in the following figure. Draw the corresponding hyperplanes in the weight space with bias $\theta = 0$ for those patterns. Explain the solution region in that weight space. (5 points)



- Use any of these constants when you need it.

$$e = 1.6 \times 10^{-19} C, \quad m_0 = 9.1 \times 10^{-31} kg, \quad K = 1.38 \times 10^{-23} J/k, \quad h = 6.625 \times 10^{-34} J/s$$
$$\epsilon_{Si} = 11.1 \times 8.85 \times 10^{-14} F/m, \quad n_i \text{ for Si at } 300 K = 1.5 \times 10^{10} /cm^3$$

The Exam lies in 6 questions – you must answer only five questions – all questions are of equal marks- 10 marks for each.

Question 1:

- a) Prove that the potential barrier in the p-n Junction in equilibrium is given by the formula: $V_{bi} = \frac{KT}{q} \ln \left(\frac{N_a N_d}{n_i^2} \right)$
- b) Silicon sample at 300 K contains an acceptor impurity concentration of $N_a = 10^{16} /cm^3$. Determine the concentration of donors that must be added so that the silicon sample is n – type and the Fermi energy is 0.2 e.v below the conduction band edge. [$n_i \text{ for Si (at } 300 K) = 1.5 \times 10^{10} /cm^3$]

Question 2:

- a) Give a reason (or reasons) for the following:
- I) Very low pressure is very important for good quality films by thermal evaporation techniques
- II) The width of the depletion layer decreases with the forward biased potential for p – n junction.
- III) The mobility of charge carrier decreases with doping concentration N_a or N_d
- IV) Thin films is very important for developing the modern everyday life.
- b) You have a p-type Si sample doped with $N_a = 3 \times 10^{15} /cm^3$. This sample is shining with light, No electric field is applied. At $x=0$, the excess carrier concentration $\delta_p(0) = \delta_n(0) = 10^{13} /cm^3$, $\mu_n = 1200 cm^2/v.s$, $\mu_p = 400 cm^2/v.s$, $\tau_{no} = 5 \times 10^{-7} sec$, $\tau_{po} = 10^{-7} sec$

Calculate:

- I) The steady state excess electrons and holes concentrations as a function of X.
- II) The electron diffusion current density as a function of X.

Question 3:

a) Drive the Einstein relation between μ_p , D_p for p-type semiconductor sample in equilibrium state.

b) Consider a silicon sample at 300 K. A Hall effect device has been fabricated with the following geometry: $d = 5 \times 10^{-3} \text{ cm}$, $w = 5 \times 10^{-3} \text{ cm}$, $L = 0.5 \text{ cm}$

-The electrical parameters measured are:

$I_x = 0.5 \text{ mA}$, $V_x = 1.25 \text{ V}$, $B_z = 6.25 \times 10^{-2} \text{ Tesla}$

- The Hall field $E = -16.5 \text{ mV/cm}$. **Determine:**

I) The Hall voltage V_H

II) The conductivity type.

III) The majority carrier concentration.

IV) The carrier mobility.

Question 4:

a) Compare between the resistive heating vacuum evaporation and d.c sputtering techniques for thin film deposition and maintain what are the advantages and disadvantage of these methods.

b) Calculate the depletion capacitance for unit area of a silicon p-n Junction at 300 K. The Junction has a reverse biased 10V and $N_a = 10^{20} / \text{cm}^3$,

$$N_d = 10^{16} / \text{cm}^3,$$

$$n_i \text{ for Si at } 300 \text{ K} = 1.5 \times 10^{10} / \text{cm}^3, \epsilon_{Si} = 11.1 \times 8.85 \times 10^{-14} \text{ F/m}$$

Question 5:

a)-Discuss the factors which affect the mobility of charge carriers in S. C materials

b)-Calculate the energy band gap of silicon at 300, 500 and 700K. Consider these constants for Si: $E_g(0) = 1.166 \text{ eV}$, $\alpha = 0.5 \times 10^{-3}$, $\beta = 636 \text{ K}$. Draw a graph for the calculated values of E_g as a function of T. What is your comment on the graph.

Question 6:

a)-Explain briefly how we can use the atmospheric pressure chemical vapor deposition (APCVD) technique to prepare SiO_2 or Si_3N_4 thin films.

b)-For a Ge sample at 300K has: $\mu_n = 0.36 \text{ m}^2/\text{V} \cdot \text{sec}$, $\mu_p = 0.17 \text{ m}^2/\text{V} \cdot \text{sec}$, the electrical conductivity $\sigma = 2.12 \Omega^{-1} \text{ m}^{-1}$. Calculate the energy band gap E_g for this sample. Consider: $[N_v = 5.64 \times 10^{18} \text{ cm}^{-3}, N_c = 1.02 \times 10^{19} \text{ cm}^{-3}]$

==== انتهى الاسئلة خالص الامنيات بالتوفيق والسداد د.عطا يوسف عبداللطيف =====



I- Write a paragraph on One only of the following:

a) Advantages and disadvantages of studying abroad

B) The right use of leisure

(10 Marks)

II-Read the following passage and answer the questions below:

As a child, you have played with objects in the bathtub, noticing that the bar of soap sank to the bottom of the water while the plastic soap dish floated on top. Why is it that many objects ranging from a piece of cork to an ocean liner will float, while others will not?

The force that makes objects float is called buoyancy. This concept was established by the great Greek mathematician Archimedes, who also played in the bathtub. Archimedes observed that when he got into his bathtub, water was displaced, or pushed out. He determined that any object immersed in a liquid is buoyed up by a force equal to the weight of the fluid displaced by the object. This is known as Archimedes' Principle. For example, suppose a rock weighs 100 pounds and has a volume of 1 cubic foot. When that rock is submerged in water, it displaces 1 cubic foot of water which weighs 62 pounds. Therefore, the gravitational pull on the rock is 100 pounds downward and the buoyant force is 62 pounds upward. Out of the water, you would need to exert a force of 100 pounds to lift the rock. In the water you would have to exert a force of 100 minus 62 pounds (or 38 pounds).

The buoyant force of a liquid, or how much it pushes upward, depends on the density of the liquid. A body will float if its density is less than the density of the liquid in which it is immersed ; it will sink if its density is greater. Ice is less dense than water, so icebergs float on the surface of the ocean. Steel ships are designed with many spaces filled with air so that their density is less than that of water.

Density is computed by dividing the weight of the liquid by its volume. Salt water has a density of 64 pounds per cubic foot, while fresh water has a density of 62 pounds per cubic foot. Hence the buoyant force of salt water is greater than that of the fresh water, which explains why it is easier for a swimmer to float in the ocean than in a lake. Similarly, an ice cube will float in a glass of water. That same ice cube would sink in pure alcohol, because alcohol has a lower density than ice. The tendency of an ice cube to sink or float in a drink depends on the proportion of water to alcohol. Be on your guard if you put an ice cube in a drink and it sinks to the bottom.

Specific gravity is the ratio of density of a substance to the density of water. Human beings have a specific gravity of approximately 1.0, which is the same as that of water. This is not surprising, considering that our bodies are two-thirds water! However, a fat person has less specific gravity than a thin person and therefore has an easier time floating.

Questions:

1- What is the name given to the force that makes objects float?

2-How is density computed?

(20 Marks)

3-Why isn't it surprising that human beings have the same specific gravity of water?

(2)

-Circle the letter of the answer that better completes each of the following sentences:

- 4-Since cork floats in water, we know that its density is _____.
a) more than that of water b) less than that of water
- 5- It is easier to float if you are _____.
a) thin b) fat
- 6-A ship will float higher in _____.
a) lake water b) ocean water
- 7-The best place to make a scientific discovery is _____.
a) in the bathtub b) not stated in the passage
- 8-An egg will float better in _____.
a) salt water b) fresh water
- 9- At a party, if an ice cube sinks to the bottom of your drink, you should _____.
a) go home b) investigate the contents of the drink.
- 10- It is easy to lift someone in the water because of _____.
a) buoyant force b) specific gravity

III-For each of the following sentences, choose the correct word:

- 1- (Their/ They're/There) going to the amusement park tomorrow.
2-Cindy (lay/lie) the book on the table.
3- I am going to (lie-lay) down for an hour.
4-(Whose/ Who) is responsible for the advertising of the event?
5-John had (less/fewer) travel time because he lives closer to the airport.

(5 Marks)

IV-Correct the verbs between brackets: some verbs are right.

- 1-Look over there! The horse [jump] over the fence.
2-They [want] to watch TV now.
3-Turn the gas off. The water [boil].
4-The children [feel] safe at the moment.
5-He usually [work] hard.

(10 Marks)

V- Translate the following into Arabic:

(5 Marks)

Some of the most important aims of education are to build up an Egyptian citizen who is able to face the future and to create a productive society. Education also aims at preparing a generation of scientists for the service of humanity.

Best Wishes