



Department of Mathematics

Faculty of Science

13 يناير 2017م

الزمن: ساعتان

امتحان التوبولوجي والهندسة التفاضلية

رقم المقرر ورمزه: M 421

قسم الرياضيات

كلية العلوم

شعبة: الرياضيات

الدرجة الكلية: 50 درجة

أجب عن خمسة فقط من الأسئلة الآتية:

1) بفرض أن τ توبولوجي على $X = \{a, b, c, d, e\}$ حيث

$$\tau = \{X, \phi, \{e\}, \{b, c\}, \{d, e\}, \{b, c, e\}, \{b, c, d, e\}\}$$

(i) أوجد أصغر مجموعة جزئية $A \subseteq X$ بحيث $A^\circ = \{d, e\}, A' = \{a, d\}$ (4 درجات)

(ii) حدد أساسا للتوبولوجي τ ثم أوجد N_a, N_e (6 درجات)

2-أ) بفرض أن $X = \{a, b, c, d\}$ ، $A = \{a, b, d\}$ حدد توبولوجي ذو أصغر رتبة

على X إن أمكن بحيث يجعل $A^\circ = \{b\}, A' = \{a\}$ (5 درجات)

ب) لأي فضاء توبولوجي (X, τ) أثبت أن $b(A) = b(A')$ حيث $A \subseteq X$. (5 درجات)

3-أ) لفضاء النقطة المستبعدة (X, ξ) أوجد $b(A), ext(A), A^\circ$ لأي $A \subseteq X$. (6 درجات)

ب) لأي فضاء توبولوجي (X, τ) أثبت أن $\bar{A} = A \cup A'$ حيث $A \subseteq X$. (4 درجات)

بقية الأسئلة خلف الورقة



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بقية الأسئلة خلف الورقة

4- Find the curvature and torsion of the curve : $r = \{4e^u, e^{2u}, 4u + 5\}$ 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

$$\cos \phi + \cos \psi = 1, \quad \cos^2 \theta = 2 \cos \phi \cos \psi \quad (10 \text{ marks})$$

5- a) Prove that the necessary and sufficient condition that the involutes of a given curve C in a plane curve is that the curve C be Helix. (5 marks)

b) Find the equation of the involute of the circle :-

$$X = a \cos \theta \underline{e}_1 + a \sin \theta \underline{e}_2, \quad a > 0 \quad (5 \text{ marks})$$

6- a) Show that for a curve lying on a Sphere of radius a and such that the torsion τ is never 0, the following equation satisfied :-

$$\left(\frac{1}{\kappa}\right)^2 + \left(\frac{\kappa'}{\kappa^2 \tau}\right)^2 = a^2$$

(5 marks)

b) Determine the curvature $\kappa(u)$ and the torsion $\tau(u)$ of the curve given by :

$$\underline{r} = \{a(u - \sin u), a(1 - \cos u), bu\}$$

Prove that :

$$\tau(0) \tau(\pi/2) (a^2 + b^2) = 1 \quad (5 \text{ marks})$$

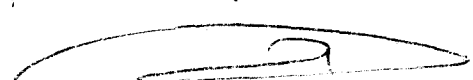
انتهت الأسئلة مع اجمل تمنياتنا بالنجاح والتوفيق

لجنة الممتحنين :-

د/ راوية عبد الرحمن حسين



أ.د / أحمد عبد المنصف علام



9. Attack that initiated by an entity inside the security perimeter
 - A. Passive.
 - B. Active.
 - C. Insider.
 - D. Outsider.
10. means used to deal with security attacks
 - A. Prevent.
 - B. Detect.
 - C. Recover.
 - D. All previous choices.

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

- 1- Discuss the term CIA Triad? (5 marks)
- 2- Mention some of the computer security challenges?(5 marks)

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

- 1-What is the main difference between passive and active attacks? (2 marks)
- 2-Define the term nonrepudiation and its types? (2 marks)
- 3-Mention the top five security technologies used in practice? (2 marks)
- 4-Explain the symmetric encryption ingredients? (4 marks)

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

- 1-Explain the methods used to attack symmetric encryption? (4 marks)
- 2- What is RFC 2828 definition for user authentication? (2 marks)
- 3- What are the general means of authenticating a user's identity? (4 marks)

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

- 1- What is ITU-T Recommendation X.800 definition for access control? (2 marks)
- 2- Explain by a figure the relationship among access control and other security functions? (2 marks)
- 3- What is NIST definition for malware? (2 marks)
- 4- Malware are mainly classified into two broadly categories. What are these categories? Discuss another method for malware classification? (4 marks)

```

s=0;
for i=1:3
s=s+I;
end
disp(s);

```

a) 0

b) 3

c) 5

d) 6

3. The output of the following code

```

c='door';
for i=1:3
disp(c(i));
end

```

a) d

o

r

b) d

o

o

c) 1

2

3

d) r

o

o

4. The error in the following code is

```

for k=5:1
disp(k-1)
end

```

a) for k=5:1
disp(k-1)
end

b) for k=5:1
disp(k-1)
end

c) for k=5:1
disp(k-1) —
end

d) non

5. In the following code

```

Function Sum = fr(a)
Sum =10;
If a >= 1
for i = 1:5
Sum = Sum+i
end

```

<i>end</i> put a=0 then the output is.....										
a) 10	b) 11	c) 25	d) 15							
6. Convert the octal number 754_8 to decimal number										
a) 469_{10}	b) 492_{10}	c) 499_{10}	d) 459_{10}							
7. The binary equivalent of 7573_8										
a) 111011101100	b) 11101111011	c) 1010110101	d) 111101111011							
8. The product of $10011 * 101$ equals										
a) 1100111	b) 1011111	c) 1101111	d) 111111							
9. The summation of $453_8 + 542_8 = \dots\dots\dots$										
a) 995_8	b) 1077_8	c) 1027_8	d) 1227_8							
10. The number 7573_8 equivalents to hexa-decimal number										
a) F7B	b) E7B	c) FF7	d) B5F							
Answer Table Section 2										
Question	1	2	3	4	5	6	7	8	9	10
Answer										

== Best Wishes ==

Dr Hanaa Sayed

Dr Alaa

Fahim

17. In flow chart, we can express to end and start with

- a)  b)  c)  d) 

18. In flow chart, we can express to the discussion with

- a)  b)  c)  d) 

19. We can classify the algorithm in three different type.....

- a) sequence, selection and branching b) branching, calculation and loop c) sequence, branching and loop d) selection, calculation and loop

20. What symbols precede comments in MATLAB

- a)'' b)% c)// d)c'

Answer Table Section 1

Question	1	2	3	4	5	6	7	8	9	10
Answer										
Question	11	12	13	14	15	16	17	18	19	20
Answer										

Section 2: from 1 to 10 (30 marks)

1. What is the value of JJ after the Matlab code below executes?

```

JJ=0;
for I=1:2:5
    JJ=JJ+1;
end
    
```

- a) 4 b)3 c)5 d) 0

2. The output of the following code is:

7. Gigabyte=			
a) 1 million bytes	b) 1 thousand bytes	c) 1 billion bytes	d) 1 trillion bytes
8. The laptop computers or notebook computers are computers			
a) Micro	b) Mainframe	c) mini	d) Super
9. A well designed computer program must be:			
a) <i>correct and accurate</i>	b) <i>easy to understand</i>	c) <i>easy to maintain and update</i>	d) a, b and c
10. occurs when the rules of programs are violated.			
a) <i>syntax error</i>	b) <i>run-time errors</i>	c) <i>logic error</i>	d) <i>comments</i>
11..... translates the program in <i>assembly-language</i> into <i>machine-language</i> .			
a) function	b) <i>Compilers</i>	c) <i>Assemblers</i>	d) <i>Interpreters</i>
12.Which Matlab command is usually used to repeat a set of commands an unknown number of times?			
a)while	b) for	c)if	d)disp
13. Let $x = [2\ 5\ 1\ 6]$. How can we compute the square root of each element			
a) square(x)	b) $x.^{(1/2)}$	c) [1.4 2.2 1 sqrt(6)]	d) $x^{(1/2)}$
14. Which Matlab commands create a vector of the even whole numbers between 31 and 75.			
a) 32:2:75	b) 31:75,2	c)31,33,...,75	d) 31-75/2
15.In Matlab, which of the following symbols cannot be used in the condition statement of an IF statement?			
a) >	b) <=	c) ==	d) =
16.Given the matrix input in Matlab $A = [1\ 5\ 7; 2\ 6\ 4; 3\ 8\ 2]$, which value is referenced by A(3,2)?			
a) 8	b) 4	c) 6	d) s

Q4	Complete <u>FIVE ONLY</u> of the following: a) _____ (1) _____ Memorizing data or references, such as data values, data collections, or references to other objects, represented as a property. b) _____ (2) _____ simulates the components that are called by the tested component. c) _____ (3) _____ is a description of how a user will use the system-to-be to accomplish business goals d) _____ (4) _____ who needs to work together, <i>not how</i> they work together e) _____ (5) _____ is a particular choice of input data to be used in testing a program f) Do not take on too many computation responsibilities is _____ (6) _____. g) _____ (7) _____ requirements define factors, such as I/O formats, storage structure, computational capabilities, timing, and synchronization.	10 marks
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Best Wishes, Dr. Hanaa A. Sayed



Scientific Computing (1) (451MC)

الزمن : ساعتان

Answer the following questions:

1-a) Explain the Box-Muller transformation method to generate random sample of size n from the Normal distribution with mean μ and standard deviation σ , and write the corresponding algorithm. (7 Marks)

b) Use an appropriate method to generate random sample of size n from the discrete uniform distribution with probability density function

$$f(x) = \frac{1}{n}, x = 1, 2, \dots, n. \quad (6 \text{ Marks})$$

2-a) Use the importance sampling method to compute the integrals: (6 Marks)

$$(i) \Phi(t) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^t e^{-\frac{z^2}{2}} dz, \quad (ii) \int_a^{\infty} \frac{1}{1+x^2} dx$$

b) Use the central limit theorem to generate random sample of size n from the binomial distribution with parameters n and p , and write the corresponding algorithm. (6 Marks)

3-a) Explain when to use the Monte Carlo integration method to compute the integrals: (i) $\int_0^{0.5} \sin x dx$, (ii) $\int_{-1}^1 |x| dx$ (6 Marks)

b) Use an appropriate method to generate random sample of size n from the Beta distribution with probability density function $f(x) = \frac{1}{B(\alpha, \beta)} x^{\alpha-1} (1-x)^{\beta-1}$, $0 < x < 1$, and write the corresponding algorithm. (6 Marks)

4-a) Write the algorithm and use the Newton method to solve the following non linear equations: $e^x - e^y = 0$, $\ln(1+x+y) = 0$, $x_0 = y_0 = 0.5$ (7 Marks)

b- Compute the constant and linear approximations for the following function by using LSP: $y(t) = e^t$, $[0, 1]$ (6 Marks)



1st Term 2016/2017

Final Exam for Level 4

Subject: Software Design and Engineering

Course No. MC467

Time: 2 Hours

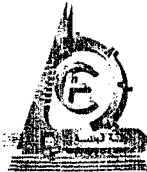
Mathematics Dept.

Faculty of Science

Assiut University

Answer the following questions (50 marks)

<p>Q1</p>	<p>a) What are the framework activities?</p> <p>b) Describe the V-Shaped SDLC model for software development and list three advantages and weaknesses for this software development.</p> <p>c) What are the main differences between equivalence testing and boundary testing</p>	<p>15 marks</p>
<p>Q2</p>	<p>a) State the requirements and use cases for the following user story” the system reads the barcode of the product and display the data of it such as price, weight, type and remaining amount of this product. If the remaining amount is less than 30 a red light flashes and add this type to required types “</p> <p>b) Define the concepts and extract the responsibilities for each concept.</p>	<p>15 marks</p>
<p>Q3</p>	<p>Show system sequence diagram and domain model for Unlock Use case.</p> <hr/> <p>Use Case UC-1: Unlock</p> <p>Related Requirements: REQ1, REQ3, REQ4, and REQ5 stated in Table 2-1</p> <p>Initiating Actor: Any of: Tenant, Landlord</p> <p>Actor’s Goal: To disarm the lock and enter, and get space lighted up automatically.</p> <p>Participating Actors: LockDevice, LightSwitch, Timer</p> <p>Preconditions: • The set of valid keys stored in the system database is non-empty. • The system displays the menu of available functions; at the door keypad the menu choices are “Lock” and “Unlock.”</p> <p>Postconditions: The auto-lock timer has started countdown from autoLockInterval.</p> <p>Flow of Events for Main Success Scenario:</p> <p>→ 1. Tenant/Landlord arrives at the door and selects the menu item “Unlock”</p> <p> 2. <u>include::AuthenticateUser (UC-7)</u></p> <p> System (a) signals to the Tenant/Landlord the lock status, e.g.,</p> <p>← 3. “disarmed,” (b) signals to LockDevice to disarm the lock, and (c) signals to LightSwitch to turn the light on</p> <p>← 4. System signals to the Timer to start the auto-lock timer countdown</p> <p> Tenant/Landlord opens the door, enters the home [and shuts the door and locks]</p> <p>→ 5.</p>	<p>10 marks</p>



Important remarks • No. of pages: 3 - No. of questions: 4 + 1 Bonus

ATTEMPT ALL QUESTIONS.

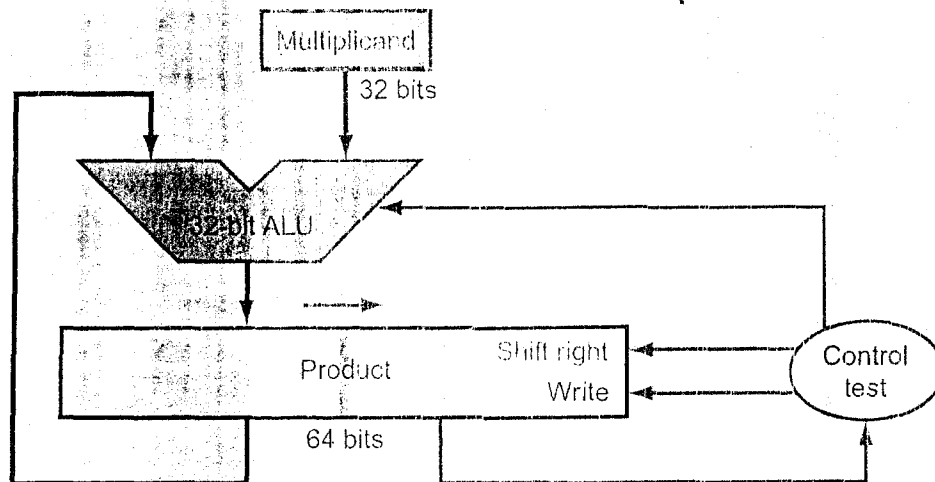
QUESTION 1 (12 POINTS)

- (a) (3 pts) State Moore's law. When and why was it no-longer applicable to microprocessor technology?
- (b) (3 pts) Write down the binary representation of the decimal number 14.125 assuming the IEEE 754 single precision format.
- (c) (6 pts) Translate the following C code to MIPS assembly code. Use a minimum number of instructions. Assume that the values of a, b, i, and j are in registers \$s0, \$s1, \$t0, and \$t1, respectively. Also, assume that register \$s2 holds the base address of the array D.

```
for (i=0; i<a; i++)
    for (j=0; j<b; j++)
        D[2*j] = i - j;
```

QUESTION 2 (12 POINTS)

- (a) (2 pts) Provide the hexadecimal representation of the machine code of following instruction:
`sw $t1, 32($t2)`
- (b) Assume that the following multiplication circuit is used but with multiplying only 4-bit numbers (both multiplicand and multiplier are 4-bit).



- (i) (1 pts) What will the size of the Product register be?
- (ii) (2 pts) How many shift operations will be executed by the control unit until we have the answer?
- (iii) (7 pts) Create a table showing the contents of the two registers in the figure as we start the operation and after each edition and shift operations until obtaining the final answer. Assume we are multiplying 6 by 5.

QUESTION 3 (10 POINTS)

- (a) (3 pts) State the role of each of the following MIPS registers in procedure calling: \$a0, \$v0, \$s0, \$t0, \$sp, and \$ra.

Faculty of Science		كلية العلوم
Department of Mathematics		قسم الرياضيات
امتحان نهائي الفصل الدراسي الاول ٢٠١٦-٢٠١٧		
التاريخ : ٢٠١٧-١-٣	م	الفرقة: الرابعة علوم
الزمن : ساعتان	شعبة : رياضيات رقم المقرر ورمزه : ٤٣١ ر	المادة هيدروديناميكا ومرونة الدرجة الكلية : ٥٠ درجة

أجب عن أربعة أسئلة فقط مما يأتي :- (١٢.٥ درجة لكل سؤال)

- ١- (أ) برهن قانون التبادل في الإجهاد المماسي . (٦.٥ درجة)
- (ب) إذا كانت مصفوفة الإجهادات المؤثرة على نقطة ما في جسم مرن مجهد هي $\begin{bmatrix} 20 & 12 & -16 \\ 12 & 40 & -8 \\ -16 & -8 & 20 \end{bmatrix}$ بوحدته قوى . احسب الإجهادات المماسية على السطح الموازي للمحور ox بحيث يصنع العمودي عليه زاوية 45° مع المحور oy . (٦ درجات)

- ٢- (أ) استنتج مجسم سطح الإنفعال . (٤ درجات)
- (ب) احسب مركبات متجه الإزاحة \vec{r} إذا علم أن مركبات الإنفعال هي $\varepsilon_x = \varepsilon_y = ax$, $\varepsilon_z = -bx$, $e_{xy} = e_{yz} = e_{zx} = 0$ (٨.٥ درجة)

- ٣- (أ) استنتج المعادلة الاستاتيكية الاتجاهية المرنة . (٦ درجات)

(ب) منبع خطي شدته m يبعد مسافة c عن محور اسطوانة دائرية نصف قطرها a إذا كان محور الاسطوانة يوازي المنبع الخطي ، ادرس الحركة. (6.5 درجة)

- (٤) (أ) استنتج معادلات حركة مائع لزج غير قابل للتضاغط . (6.5 درجة)
- (ب) اسطوانة مقطوعها مربع محدد بالمستقيمات $x=y=+a$. أوجد قانون السرعة لمائع لزج غير قابل للتضاغط ينساب داخل هذه الاسطوانة الطويلة . (6 درجات)

(٥) (أ) استخدم نظرية باي للتحليل البعدي في حساب قانون المقاومة علي وحدة السطوح من جدار انبوبة بفرض انها دالة في كل من معامل اللزوجة والكثافة و القطرو السرعة المتوسطة للتدفق .

- (6 درجات)
- (ب) اكتب مع البرهان نظرية بلازيوس . (3 درجات)
- (ج) استنتج معادلات الطبقة الجدارية في بعدين . (3.5 درجة)

انتهت الاسئلة أ. د. فكري حادي ، د. حسين حماد



Scientific Computing (1) (451MC)

الزمن : ساعتان

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b- Compute the constant and linear approximations for the following function by using LSP: $y(t) = e^t$, $[0, 1]$ (6 Marks)

Fifth Question (13 Degree)

(a) Let $B(X, Y)$ be the space of all linear and bounded operators on a normed space X

into a normed space Y . Prove that if Y is a Banach space then $B(X, Y)$ is also a Banach space.

(b) Let $f : C[0, 1] \rightarrow \mathbb{R}$ be a functional defined by:

$$f(x) = \int_a^b x(t) dt, \quad x(t) \in C[a, b].$$

Show that f is linear, bounded and $\|f\| = b - a$.

(c) Give an example of a metric space which is not a normed space with proof.

Prof.R.A.Rashwan

The End

Answer the following questions by using MATLAB language: (50 marks)

1- (a)- Write a *MATLAB* program to compute an iterative formula $\sqrt[n]{N}$, where N is a positive number and hence find $\sqrt[3]{19}$?

(b) Using the Bisection Method to find a solution to $f(x) = 0$

(I) Write a *MATLAB* program for approximating the solution to

$$2x^3 - x^2 + 5 = 0 \text{ for } -2 \leq x \leq -1 \text{ to within } 10^{-5}$$

(II) Compute the exact solution using *MATLAB*.

(III) Compute the actual error.

2- (a) Using Lagrange interpolation polynomial, write a *MATLAB* program for approximating $y(0.1)$ and $y'(0.1)$ from the table below:

X	0.0	0.2	0.4	0.6	0.8
Y	1.000	1.22140	1.49182	1.82212	2.22554

(b) Solve the system of differential equations by the Runge Kutta method of order 4:

$$\frac{dx}{dt} = x + 2y, \quad \frac{dy}{dt} = 3x + 2y, \quad x(0) = 6, y(0) = 4, \quad n = 100, \quad 0 \leq t \leq 1,$$

and compare them with the analytic solution

$$x(t) = 4e^{4t} + 2e^{-t}, \quad y(t) = 6e^{4t} - 2e^{-t}.$$

3- (a) Write a *MATLAB* program for approximating $\int_0^1 \frac{2}{6x+3} dx$ using the composite Simpson's Rule at $n=10$ and use it to calculate approximately $\ln 3$.

(b) Solve the differential equation by Taylor's method of order 4:

$$\frac{dy}{dt} = 2ty^2, \quad y(0) = 1, \quad h = 0.01.$$

4-(a) Solve the differential equation by Hamming method at $x=0.2$:

$$\frac{dy}{dt} = t^2 - y, \quad y(0) = 1, \quad h = 0.05$$

and compare it with the analytic solution $y = -e^{-t} + t^2 - 2t + 2$.

(b) Which does *MATLAB* language consist?, what are the types of constants and variables in the language of *MATLAB*?

5- Solve the differential equation by finite difference method:

$$\frac{d^2y}{dx^2} + y = 0, \quad y(0) = 1, \quad \frac{dy}{dx}(0) = 0, \quad 0 \leq x \leq 5, \quad \Delta x = 0.1.$$

Good Luck

MIPS Reference Cheat Sheet

INSTRUCTION SET (SUBSET)

Name (format, op, funct)	Syntax	Operation
add (R,0,32)	add rd,rs,rt	reg(rd) := reg(rs) + reg(rt);
add immediate (I,8,na)	addi rt,rs,imm	reg(rt) := reg(rs) + signext(imm);
add immediate unsigned (I,9,na)	addiu rt,rs,imm	reg(rt) := reg(rs) + signext(imm);
add unsigned (R,0,33)	addu rd,rs,rt	reg(rd) := reg(rs) + reg(rt);
and (R,0,36)	and rd,rs,rt	reg(rd) := reg(rs) & reg(rt);
and immediate (I,12,na)	andi rt,rs,imm	reg(rt) := reg(rs) & zeroext(imm);
branch on equal (I,4,na)	beq rs,rt,label	if reg(rs) == reg(rt) then PC = BTA else NOP;
branch on not equal (I,5,na)	bne rs,rt,label	if reg(rs) != reg(rt) then PC = BTA else NOP;
jump and link register (R,0,9)	jalr rs	PC := PC + 4; PC := reg(rs);
jump register (R,0,8)	jr rs	PC := reg(rs);
jump (J,2,na)	j label	PC := JTA;
jump and link (J,3,na)	jal label	PC := PC + 4; PC := JTA;
load byte (I,3,na)	lb rt,imm(rs)	reg(rt) := signext(mem[reg(rs) + signext(imm)] _{7:0});
load byte unsigned (I,36,na)	lbu rt,imm(rs)	reg(rt) := zeroext(mem[reg(rs) + signext(imm)] _{7:0});
load upper immediate (I,14,na)	lui rt,imm	reg(rt) := concat(imm, 16 bits of 0);
load word (I,35,na)	lw rt,imm(rs)	reg(rt) := mem[reg(rs) + signext(imm)];
multiply, 32-bit result (R,28,2)	mul rd,rs,rt	reg(rd) := reg(rs) * reg(rt);
nor (R,0,39)	nor rd,rs,rt	reg(rd) := not(reg(rs) reg(rt));
or (R,0,37)	or rd,rs,rt	reg(rd) := reg(rs) reg(rt);
or immediate (I,13,na)	ori rt,rs,imm	reg(rt) := reg(rs) zeroext(imm);
set less than (I,0,42)	slt rd,rs,rt	reg(rd) := if reg(rs) < reg(rt) then 1 else 0;
set less than unsigned (R,0,43)	sltu rd,rs,rt	reg(rd) := if reg(rs) < reg(rt) then 1 else 0;
set less than immediate (I,10,na)	slti rt,rs,imm	reg(rt) := if reg(rs) < signext(imm) then 1 else 0;
set less than immediate unsigned (I,11,na)	sltiu rt,rs,imm	reg(rt) := if reg(rs) < signext(imm) then 1 else 0;
shift left logical (R,0,0)	sll rd,rt,shamt	reg(rd) := reg(rt) << shamt;
shift left logical variable (R,0,4)	sllv rd,rt,rs	reg(rd) := reg(rt) << reg(rs _{4:0});
shift right arithmetic (R,0,3)	sra rd,rt,shamt	reg(rd) := reg(rt) >>> shamt;
shift right logical (R,0,2)	srl rd,rt,shamt	reg(rd) := reg(rt) >> shamt;
shift right logical variable (R,0,6)	srlv rd,rt,rs	reg(rd) := reg(rt) >>> reg(rs _{4:0});
store byte (I,40,na)	sb rt,imm(rs)	mem[reg(rs) + signext(imm)] _{7:0} := reg(rt) _{7:0} ;
store word (I,43,na)	sw rt,imm(rs)	mem[reg(rs) + signext(imm)] := reg(rt);
subtract (R,0,34)	sub rd,rs,rt	reg(rd) := reg(rs) - reg(rt);
subtract unsigned (R,0,35)	subu rd,rs,rt	reg(rd) := reg(rs) - reg(rt);
xor (R,0,38)	xor rd,rs,rt	reg(rd) := reg(rs) ^ reg(rt);
xor immediate (I,14,na)	xori rt,rs,imm	reg(rt) := reg(rs) ^ zeroext(imm);

Definitions

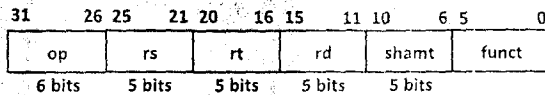
- Jump to target address: JTA = concat((PC + 4)_{31:28}, address(label), 00₂)
- Branch target address: BTA = PC + 4 + imm * 4

Clarifications

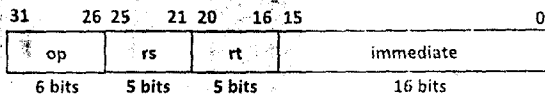
- All numbers are given in decimal form (base 10).
- Function signext(x) returns a 32-bit sign extended value of x in two's complement form.
- Function zeroext(x) returns a 32-bit value, where zero are added to the most significant side of x.
- Function concat(x, y, ..., z) concatenates the bits of expressions x, y, ..., z.
- Subscripts, for instance X_{8:2}, means that bits with index 8 to 2 are spliced out of the integer X.
- Function address(x) means the address of label x.
- NOP and na means "no operation" and "not applicable", respectively.
- shamt is an abbreviation for "shift amount", i.e. how much bit shifting that should be done.

INSTRUCTION FORMAT

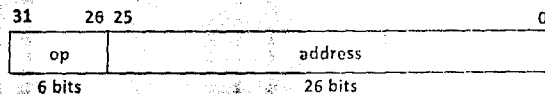
R-Type



I-Type



J-Type



REGISTERS

Name	Number	Description
\$zero	0	constant value 0
\$at	1	assembler temp
\$v0	2	function return
\$v1	3	function return
\$a0	4	argument
\$a1	5	argument
\$a2	6	argument
\$a3	7	argument
\$t0	8	temporary value
\$t1	9	temporary value
\$t2	10	temporary value
\$t3	11	temporary value
\$t4	12	temporary value
\$t5	13	temporary value
\$t6	14	temporary value
\$t7	15	temporary value
\$s0	16	saved temporary
\$s1	17	saved temporary
\$s2	18	saved temporary
\$s3	19	saved temporary
\$s4	20	saved temporary
\$s5	21	saved temporary
\$s6	22	saved temporary
\$s7	23	saved temporary
\$t8	24	temporary value
\$t9	25	temporary value
\$k0	26	reserved for OS
\$k1	27	reserved for OS
\$gp	28	global pointer
\$sp	29	stack pointer
\$fp	30	frame pointer
\$ra	31	return address

IEEE 754 Float-Point Formats

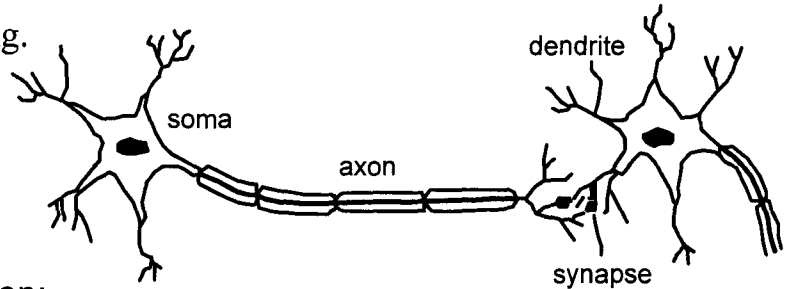
Floating Point Components

	Sign	Exponent	Fraction
Single Precision	1 [31]	8 [30-23]	23 [22-0]
Double Precision	1 [63]	11 [62-52]	52 [51-0]



Question 1: 10 points.

1. List three definitions for Machine Learning.
2. Explain the following figure:



Question 2: 10 points.

Use Perceptron algorithm to learn the function:

$$\left\{ \mathbf{p}_1 = \begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}, t_1 = [0] \right\}, \left\{ \mathbf{p}_2 = \begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}, t_2 = [1] \right\}$$

Question 3: 15 points

1. Explain Naïve Bayes algorithm.
2. Consider a table containing the following instances:

age	income	student	credit_rating	buys_computer
<=30	high	No	fair	no
<=30	high	No	excellent	no
31...40	high	No	fair	yes
>40	medium	No	fair	yes
>40	low	Yes	fair	yes
>40	low	Yes	excellent	no
31...40	low	Yes	excellent	yes
<=30	medium	No	fair	no
<=30	low	Yes	fair	yes
>40	medium	Yes	fair	yes
<=30	medium	Yes	excellent	yes
31...40	medium	No	excellent	yes
31...40	high	Yes	fair	yes
>40	medium	No	excellent	no

Using Naïve Bayes approach to predict the class label for the test sample $X = (\text{age} \leq 30, \text{Income} = \text{medium}, \text{Student} = \text{yes}, \text{Credit_rating} = \text{Fair})$

Question 4: 15 points

1. What is the goal of the SVM algorithm? When can be it successfully applied?
2. What is the margin? Which are the equations of the two margin hyperplans H^+ and H^- ?
3. Summarize the main advantages and limitations of SVM.



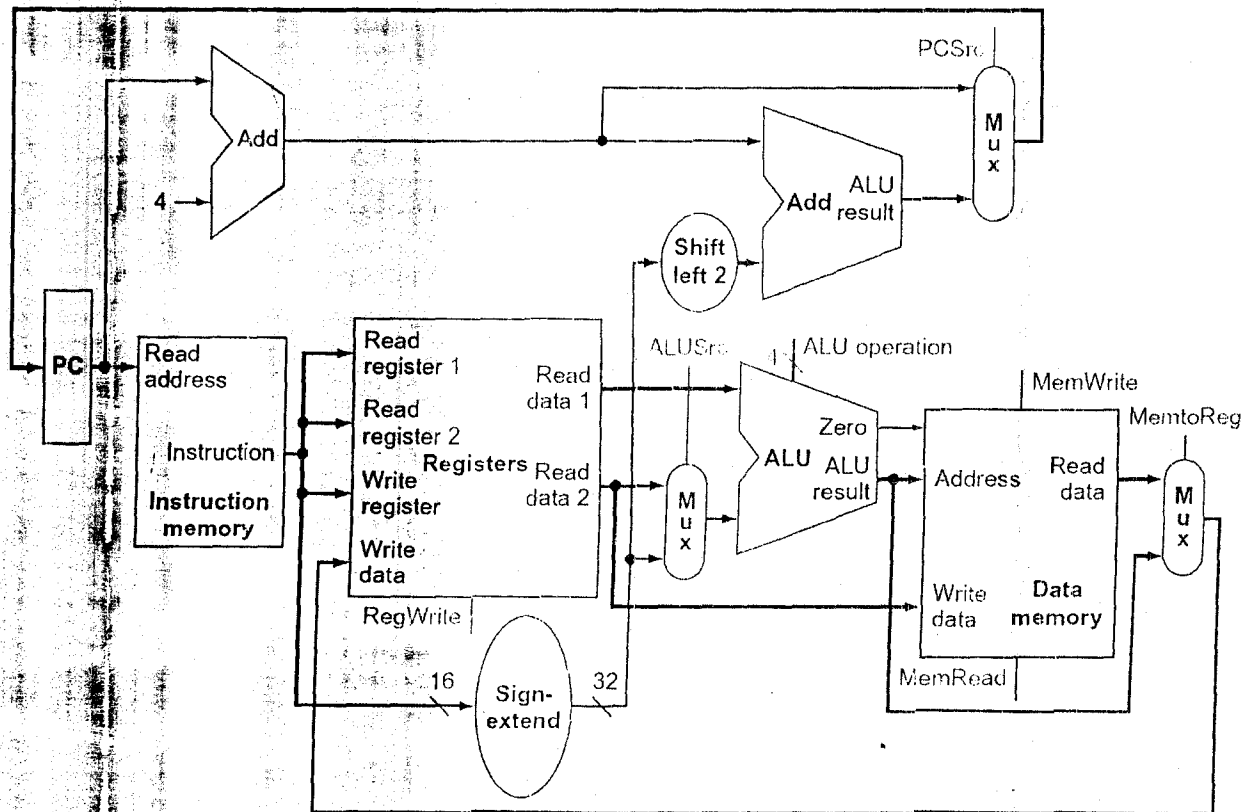
Q.1 Choose the correct answer (15 marks)

1. The input to the system is the scene description and output is a static or animated scene to be displayed in
 - a) *Active* Graphics systems
 - b) *Passive* Graphics systems
 - c) *A and b*
2. is the specification of an Application Programming Interface (API)
 - a) Gl library
 - b) Glu library
 - c) Glut library
3. configures the type of window we want to use with our application.
 - a) glutInit()
 - b) glutInitDisplayMode()
 - c) glutCreateWindow(),
4. selects which matrix subsequent functions will affect
 - a) glMatrixMode()
 - b) glLoadIdentity()
 - c) glOrtho()
5. Rotation about an arbitrary point P in 2D space steps are:.....
 - a) Translate by (-Px, -Py), Rotate and Translate by (Px, Py)
 - b) Translate by (-Px, -Py), Translate by (Px, Py) and Rotate
 - c) Rotate, Translate by (-Px, -Py) and Translate by (Px, Py)
6. where the scene and viewing specification is made
 - a) World Space
 - b) Object Space
 - c) Screen Space
7. is used to rotate point around X axis
 - a) glRotatef(90.0, 0.0, 0.0, 1.0);
 - b) glRotatef(90.0, 1.0, 0.0, 0.0);
 - c) glRotatef(90.0, 0.0, 1.0, 1.0);
8. glutSetWindow used to.....
 - a) find out which window is currently
 - b) destroy windows
 - c) select a window to render
9. allow us to use area averaging instead of point samples
 - a) Wrapping parameters
 - b) Filter modes
 - c) Clamping
10. single color per polygon
 - a) Smooth shading
 - b) Flat shading
 - c) Wireframe

- (b) (7 pts) Implement the C function `strcount(char* str, char x)` in MIPS Assembly. The function accepts a string `str` of ASCII characters terminated with the NULL character, and a character `x`. It returns the number of occurrences of the character `x` in the string `str`. For example, `strcount("hello", 'l')` returns 2.

QUESTION 4 (16 points)

Answer the following questions using the given simplified single-clock MIPS processor design:



- (i) (2 pts) Why must this design have separate instruction and data memories?
- (ii) (9 pts) What are the values of the control signals: `RegWrite`, `MemRead`, `ALUSrc`, `MemWrite`, `ALUOperation`, `MemtoReg`, and `PCSrc` in each of the following instructions:
- 1) `add $t2, $t2, $t3`
 - 2) `lw $t1, 8($s2)`
 - 3) `beq $t1, $2, offset`
- (iii) (2 pts) If the offset in a jump instruction is `0x8E47`, what are the outputs of the sign-extend and the jump "Shift left 2" units?
- (iv) (1 pts) What is the ALU's Zero output needed for?
- (v) (2 pts) Why is a single-cycle processor implementation NOT used Today?

BONUS QUESTION 5 (5 POINTS)

Consider three branch prediction schemes: predict not taken, predict taken, and dynamic prediction. Assume that they all have zero penalty when they predict correctly and two cycles when they are wrong. Assume that the average predict accuracy of the dynamic predictor is 90%. Which predictor is the best choice for the following branches?

- (i) A branch that is taken with 5% frequency
- (ii) A branch that is taken with 95% frequency
- (iii) A branch that is taken with 70% frequency



Choose the correct answer and write it in the answer table:

Section 1: from 1 to 20 (20 marks)

1. temporarily stores data and program instructions during processing

- | | | | |
|--------------------|--------|--------|----------------------|
| a) Primary storage | b) RAM | c) ALU | d) Secondary storage |
|--------------------|--------|--------|----------------------|

2. The devices convert electronic data produced by the computer system and display them in a form that people can understand.

- | | | | |
|------------------|-------------------|--------------------------|-----------------|
| a) Input devices | b) Output devices | c) Communication devices | d) control unit |
|------------------|-------------------|--------------------------|-----------------|

3. The devices provide connections between the computer and communications networks.

- | | | | |
|------------------|-------------------|--------------------------|-----------------|
| a) Input devices | b) Output devices | c) Communication devices | d) control unit |
|------------------|-------------------|--------------------------|-----------------|

4. Where the manipulation of symbols, numbers, and letters occurs, and it controls the other parts of the computer system.

- | | | | |
|--------|--------|-----------------|--------|
| a) RAM | b) ROM | c) system board | d) CPU |
|--------|--------|-----------------|--------|

5. Directs and coordinates operations in computer

- | | | | |
|-----------------|--------|--------|--------|
| a) Control unit | b) CPU | c) RAM | d) ROM |
|-----------------|--------|--------|--------|

6. A visual display unit is an example of

- | | | | |
|------------------|-------------------------|-------------------|------------|
| a) output device | b) input/output devices | c) backup devices | d) mediums |
|------------------|-------------------------|-------------------|------------|

4- Find the curvature and torsion of the curve : $r = \{4 e^u , e^{2u} , 4u + 5\}$ 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

$$\cos \phi + \cos \psi = 1 \quad , \quad \cos^2 \theta = 2 \cos \phi \cos \psi \quad (10 \text{ marks})$$

5- a) Prove that the necessary and sufficient condition that the involutes of a given curve C in a plane curve is that the curve C be Helix. (5 marks)

b) Find the equation of the involute of the circle :-

$$X = a \cos \theta \underline{e}_1 + a \sin \theta \underline{e}_2 \quad , \quad a > 0 \quad (5 \text{ marks})$$

6- a) Show that for a curve lying on a Sphere of radius a and such that the torsion τ is never 0, the following equation satisfied :-

$$\left(\frac{1}{\kappa}\right)^2 + \left(\frac{\kappa'}{\kappa^2 \tau}\right)^2 = a^2$$

(5 marks)

b) Determine the curvature $\kappa(u)$ and the torsion $\tau(u)$ of the curve given by :

$$\underline{r} = \{a(u - \sin u) , a(1 - \cos u) , bu\}$$

Prove that :

$$\tau(0) \tau(\pi/2) (a^2 + b^2) = 1 \quad (5 \text{ marks})$$

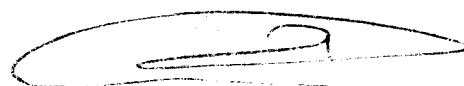
انتهت الأسئلة مع اجمل تمنياتنا بالنجاح والتوفيق

لجنة الممتحنين :-

د/ راوية عبد الرحمن حسين



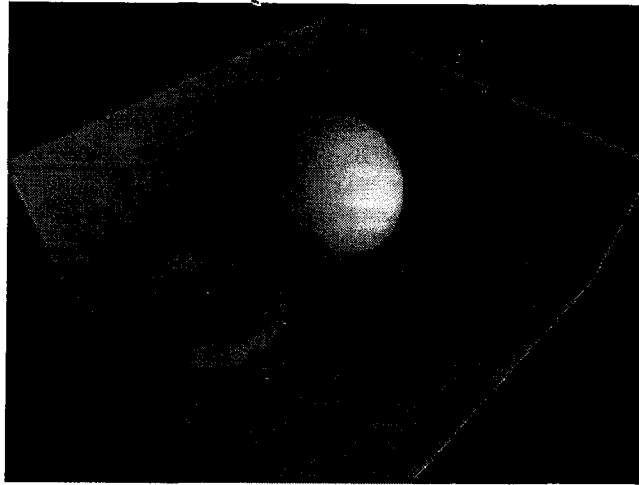
أ.د / أحمد عبد المنصف علام



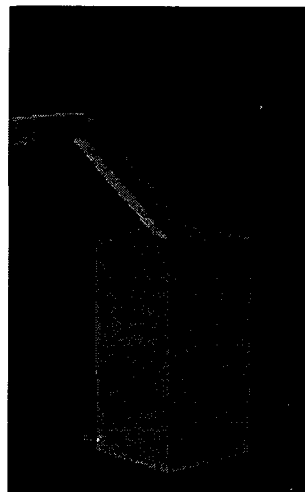
Q.2 What are the differences between? (10 marks)

- a) the function `glOrtho()` and the function `gluPerspective()`
- b) Double-buffering and depth buffer
- c) Magnification and Minification

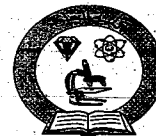
Q.3 Write the display function that draws the scene shown in the image below(15 marks)



Q.4 Write the display function that draws the scene shown in the image below (10 marks)



Best Wishes, *Dr. Hanaa A. Sayed*



Answer four questions only from the following questions:

First Question (12 Degree)

(a) Are d as defined below by:

$$d(x, y) = (x_1 - y_1)^2 + (x_2 - y_2)^2, \quad x = (x_1, x_2), y = (y_1, y_2), x, y \in R^2,$$

defines a metric on R^2 .

(b) Show that every convergent sequence in a metric space (X, d) is a Cauchy sequence but the converse is not true.

(c) Show that the space ℓ^∞ with a metric: $d(x, y) = \sup |x_i - y_i|$ $x, y \in \ell^\infty$ is complete.

Second Question (12 Degree)

(a) Give an example of non-complete metric space with proof.

(b) Let T be a mapping of (R, d) into itself. Show that the condition:

$$d(Tx, Ty) < d(x, y), \quad x \neq y$$

is insufficient for the existence of a fixed point of T .

(c) If T is a contraction mapping, show that T^n ($n \in N$) is a contraction. If T^n is a contraction for $n > 1$.

Show that T need not be a contraction.

Third Question (13 Degree)

(a) Using Banach fixed point theorem to show that the differential equation:

$$y'(t) = f(t, y(t)), \quad y(a) = y_0,$$

has a unique solution in $C[a, b]$.

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

(c) Let $X = R^n$ with the norm:

$$\|x\|_p = \left(\sum_{i=1}^n |x_i|^p \right)^{1/p}, \quad 0 < p < 1, n > 2, x \in R^n.$$

Show that $(X, \|\cdot\|_p)$ is not a normed space.

Fourth Question (13 Degree)

(a) Prove that the space ℓ^p ($1 \leq p \leq \infty$) with a norm: $\|x\|_p = \left(\sum_{i=1}^{\infty} |x_i|^p \right)^{1/p}$ is a Banach space

(b) Show that any two norms $\|\cdot\|_1$ and $\|\cdot\|_2$ on R^n are equivalent. and give examples with proof

for two equivalent norms and for two nonequivalent norms.

(c) Prove that on a finite dimensional normed space $(X, \|\cdot\|)$ every linear operator on X is bounded, and show that a differential operator is unbounded.



امتحان نهائي الفصل الدراسي الاول ٢٠١٦/٢٠١٧ م

تاريخ الامتحان ٢٠١٧/١/٢

الدرجة الكلية: ٥٠ درجة

المستوى الرابع

الزمن: ثلاث ساعات

المقرر: (٤١٤ ر) معادلات تفاضلية جزئية

أجب عن خمسة فقط مما يأتي: (١٠ درجات عن كل سؤال - بواقع ٥ درجات عن كل فقرة)

١- أ) باستخدام طريقة لابلاس - أوجد الحل العام للمعادلة التفاضلية

$$6t - s - r = 18 \quad x - 4y$$

ب) عين كلا من الحل الكامل والحل المفرد للمعادلة التفاضلية : $z = 3xp + 3yq + \frac{1}{z^6 p q}$

٢- أ) باستخدام طريقة أويلر - أوجد الحل العام للمعادلة التفاضلية

$$y^2 u_{yy} + 2xy u_{xy} - y u_y = \frac{y^2}{x^2}$$

ب) بفرض أن $u = \frac{1}{r} f(r) \cos(\omega t + \alpha)$ هو حل للمعادلة التفاضلية $u_{rr} + \frac{2}{r} u_r = \frac{1}{c^2} u_{tt}$ حيث ω, α, c ثوابت، أوجد

المعادلة التفاضلية العادية التي تحققها الدالة $f(r)$ وأعط الحل العام لها. وإذا علم أنه لجميع قيم t يكون u محدودة عند $r = 0$ ،

$$u_r = 0 \text{ عند } r = a, \text{ وأن } u \neq 0 \text{ تطابقا. فاثبت أن } \frac{\omega a}{c} = \beta \text{ يجب أن تحقق المعادلة } \tan \beta = \beta$$

٣- أ) عين الشرط اللازم لكي يكون النظام $p_1 x_1 + p_2 x_2 = p_3^2$ ، $p_1 + p_3 = p_2 + 1$ متوافق، ثم أوجد الحل الكامل لهذا النظام.

ب) أوجد الحل العام للمعادلة التفاضلية $r - y p = e^{xy}$

٤- أ) باستخدام طريقة جاكوبي - أوجد الحل الكامل للمعادلة التفاضلية $(x_2 + x_3)(p_2 + p_3)^2 + z p_1 = 0$

ب) أوجد حل المعادلة التفاضلية $x^2 u_{xx} + x u_x + u_{yy} = 0$ على الصورة $u = XY$ بحيث تحتوي Y على دوال مثلثية فقط،

$$\text{والدالة } u \text{ تحقق الشروط } u_x = -\cos(2y) \text{ when } x = a, u \rightarrow 0 \text{ as } x \rightarrow \infty$$

٥- أ) باستخدام طريقة شاربت - عين كلا من الحل الكامل والحل المفرد (إن وجد) للمعادلة التفاضلية

$$p = -yq + q^2$$

ب) حل معادلات البث: $V_x = -LI_l$ ، $I_x = -cV_l$ والتي تحقق الشروط $I(x, 0) = I_0$ ، $V(x, 0) = V_0 \sin(\frac{\pi x}{l})$ حيث V هو

الجهد، I التيار، L (معامل الحث)، $c \in R^+$

٦- أ) باستخدام طريقة مونج - عين الحل الكامل للمعادلة التفاضلية $q^2 r - 2pqs + p^2 t = 0$

ب) أوجد الحل العام للمعادلة التفاضلية $z_{xy} = x^2 y$ ثم أوجد الحل الخاص الذي يحقق الشروط

$$z(x, 0) = x^2, \quad z(1, y) = \cos y$$