Mansoura University
Faculty of Science
Mathematics Department
Statistics and Computer Science

Operating System
Concepts (ر٢٤٥)
Mon: 18th May, 2015
Dr. Bahaa Shabana

Answer the following (5 – Five) questions:

1. Write short notes for each of the following:

1.1. Backing store.

1.2. Context switching

1.3. CPU Scheduler.

1.4. Lazy Swapping.

1.5. Linked allocation.

1.6. Interrupt.

1.7. Segmentation.

1.8. PCB.

2. Question Two

2.1. What are the three main purposes of an operating system?

2.2. What is the difference between Batch operating system and Multi-programed operating system?

2.3. What are the different states of the process? (Draw a diagram).

2.4. What the advantages and disadvantages are of file indexed allocation?

3. Question Three

3.1. Explain the difference between preemptive and non-preemptive scheduling.

Consider the following set of processes, with the length of the CPU burst given in milliseconds:

Process	Burst Time
P_1	6
P_2	4
P_3	8
P_4	7

3.2. Draw Gantt charts that illustrate the execution of these processes using:

3.2.1. FCFS algorithm.

3.2.2. SJF (non-preemptive) algorithm.

3.2.3. RR algorithm, with quantum = 5.

4. Question Four: Consider the following page reference string:

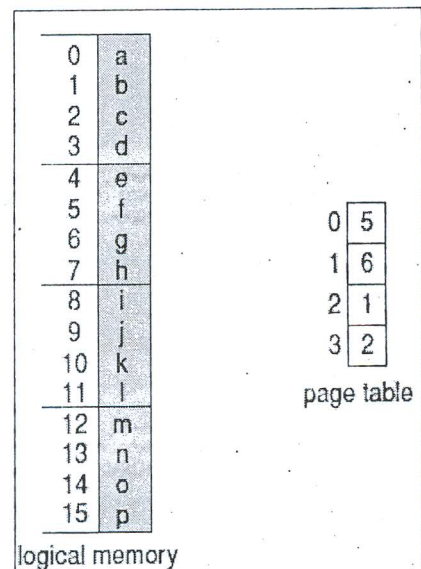**1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 1, 2, 3, 6.**

Draw the suitable figures showing **the 4 (Four) frames** allocation using, and count the number of page faults, for each of:

4.1. FIFO (first in first out) page replacement algorithm.

4.2. LRU (least recently used) page replacement algorithm.

4.3. Optimal page replacement algorithm.

5. Question Five:

Use figure and answer the following:

5.1. What is the minimum number of frames?

5.2. What is the physical frame for page 2.

5.3. Calculate the physical address for letter "n".

5.4. Draw a sketch for the physical memory.

0	a
1	b
2	c
3	d
4	e
5	f
6	g
7	h
8	i
9	j
10	k
11	l
12	m
13	n
14	o
15	p

logical memory

0	5
1	6
2	1
3	2

page table

Best Wishes

Dr. Bahaa Shabana

Faculty of Science
Mathematics Department

3ᵗʰ Level Exam
Mathematics
Statistics & Computer Science

Integral Equations

May 2015

Time : 2 hours

Full mark 80

[1] a) Reduce the initial value problem

$$y'' + x\,y' + y = 0, \qquad y(0) = 1, \quad y'(0) = 0,$$

to a Voltera - type integral equation   (10 marks)

b) Find the resolvent kernel of the integral equation

$$\phi(x) = x3^x - \int_0^x 3^{x-t}\,\phi(t)dt \qquad \text{and then find its solution} \qquad \text{(10 marks)}$$

[2] Solve the system of integral equations

$$\phi_1(x) = x + \int_0^x \phi_2(t)dt; \quad \phi_2(x) = 1 - \int_0^x \phi_1(t)dt;$$

$$\phi_3(x) = \sin x + \frac{1}{2}\int_0^x (x - t)\phi_1(t)dt; \qquad \text{(15 marks)}$$

[3] a) Using Fredholm determinant, find the resolvent kernel of the integral equation

$$\phi(x) = e^x - \int_0^1 xe^t\,\phi(t)dt, \qquad \text{and then find its solution} \qquad \text{(10 marks)}$$

b) Solve the following integral equation

$$\int_0^x 2 + x^2 - t^2)\phi(t)dt = x^2. \qquad \text{(10 marks)}$$

[4] a) Show that $\phi(x) = a + bx + \int_0^x [c + d(x - t)]\,\phi(t)dt,$

where a, b, c, d are arbitrary constants, has the solution

$$\phi(x) = \alpha e^{\lambda x} + \beta e^{\nu x}, \qquad \text{(10 marks)}$$

where α, β, λ, ν depend upon a, b, c, d .

b) Find the characteristic values and Eigen functions of the integral equations

$$\varphi(x) - \lambda \int_1^2 (x + t)\varphi(t)\,dt = 0. \qquad \text{(15 marks)}$$

Best Wishes

Dr. Mahmoud Abdelaziz

You should attempt all questions unless stated otherwise. All questions carry equal marks.

Question (1). Answer the following questions (answer 12 only):

What is the result if you execute the following statements in Maple command Window ?

NO	Command entered (one by one)	What I see in Maple window
1	A1 := (100-9)*(100+9);	
2	A2 := directory / filename ;	
3	A3:= [seq (sin (Pi*i/6) , i= 0..6));	
4	A4 := Sum (r , r = 1..100);	
5	A5 := linalg [band] ([1] , 5);	
6	A6 := combine (3*ln(2) - 2*ln(3), ln) ;	
7	A7 := convert (65, octal);	
8	A8 := ithprime (10) + 23 mod 7 ;	
9	A9 := igcd (12,18)+ ilcm (18,12) ;	
10	A10 := ceil (41.6) / iquo (20,3) ;	
11	A11 := op (2, x^2+y^3+z^4);	
12	A12 := D (ln + exp) (5) ;	
13	A13 := series (exp (x), x=0);	
14	A14 := map (k-> k^2+1, [1,2,3,4]);	
15	A15 := sum (r^2 , r) ;	

Question (2). Answer the following questions:

What would you enter to Maple in order to accomplish the following tasks?

(1) Prove: If a ,b, c are the roots of the equation $x^3 + p\,x^2 + q\,x + r = 0$, then

$$\frac{(1+a^2)(1+b^2)(1+c^2)}{(1-q)^2 + (p-r)^2} = 1$$

(2) To compute and display the smallest integer n such that $2^n > 50000$.

(3) Prove : $\sum_{k=1}^{\infty} \frac{1}{k^2} = \frac{\pi^2}{6}$

P.T.O.

(4) If $X = ax + cy + bz$, $Y = cx + by + az$ and $Z = bx + ay + cz$, prove that:

$$X^3 + Y^3 + Z^3 - 3XYZ = (a^3 + b^3 + c^3 - 3abc)(x^3 + y^3 + z^3 - 3xyz)$$

(5) Factorize the determinant $T = \begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix}$.

Question (3). Answer the following questions (answer 3 only):

3-a) Define a **Maple function** called g using if-then-else-fi to generate the following sequence:

$$x, \frac{1}{x^2}, x^3, \frac{1}{x^4}, x^5, \frac{1}{x^6}, x^7, \frac{1}{x^8}, x^9, \frac{1}{x^{10}}, x^{11}, \frac{1}{x^{12}}, x^{13}, \frac{1}{x^{14}}, x^{15}, \frac{1}{x^{16}}, x^{17}, \frac{1}{x^{18}}, x^{19}, \frac{1}{x^{20}}.$$

3-b) Write the Maple output of the following **Maple procedure:**

```
> restart :
  S3 := proc(n)  local x , k ; x := 0 :
      for k  by 2 to 2 * n  do  x := x + k* k ; od : x := x / n:
  end proc:
> S3(5);
```

3-c) Write a **Maple code** using nested for-do loops to generate the following matrix

$$A = \begin{bmatrix} 12 & 8 & 4 & 0 & -4 \\ 14 & 10 & 6 & 2 & -2 \\ 16 & 12 & 8 & 4 & 0 \end{bmatrix}$$
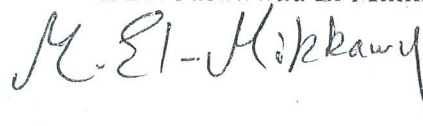
without typing the numbers explicitly.

3-d) Write the Maple output of the following **Maple code:**

```
> restart: L := [a , b, c, d, e, 5, 4, 3, 2, 1]:
> for k in L do
     if not  type (k , integer) then
        print ( k )
     else
        print ( k* k )
     fi;
  od;
```

3-e) Write a **Maple code** to compute the number of years it takes for a $1000 principal to grow to $10000 at 6% annual interest.

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Kind regards,

Examiner : Prof. Dr. Moawwad El-Mikkawy

Mansoura University- Faculty of Science
Department: Mathematics
Subject   : Mathematical Logic
Date   : 29/5/2015

Level   : 3
Subject code: math 340
Time   : (2) hours

Final-Term Examination second Semester 2014/2015

Answer ALL questions:

Q1: (10 Marks)

a) Suppose *u* represents "you understand the material", *s* represents "you study the theory", and *w* represents "you work on exercises". Write the following compound proposition using *u, s, w*, and appropriate connectives. "When you study the theory and work on exercises, you understand the material."

b) Are these system specifications consistent? "The user has contacted the network administrator, but does not enter a valid password". "Access is granted منح whenever the user has contacted the network administrator or enters a valid password". "Access is denied رفض if the user has not entered a valid password or has not contacted اتصل the network administrator مدير".

Q2: (20 Marks)

a) Simplify the following Boolean function F, together with the don't-care conditions d, and then implement the simplified function with NOR gates.

F (A, B, C, D) = Σ (0, 2, 3, 5, 6, 7, 8, 9) + d (10, 11, 12, 13, 14, 15)

b) Design a half-adder using NAND gates only.

Q3: (20 Marks)

a) Translate these statements into English, where C(x) is "x is a comedian" and F(x) is "x is funny" and the domain consists of all people.

1) $\forall x(C(x) \rightarrow F(x))$ 2) $\forall x(C(x) \wedge F(x))$
3) $\exists x(C(x) \rightarrow F(x))$ 4) $\exists x(C(x) \wedge F(x))$

b) Let P(x) is the statement "x can speak Russian" and let Q(x) be the statement "x knows the computer language C++." Express each of these sentences in terms of P(x), Q(x), quantifiers, and logical connectives. The domain for quantifiers consists of all students at your school.

1) There is a student at your school who can speak Russian and who knows C++.
2) There is a student at your school who can speak Russian but who doesn't know C++.
3) Every student at your school either can speak Russian or knows C++.
4) No student at your school can speak Russian or knows C++.

Q4: (20 Marks)

Write a Prolog program that represents the following database:
-Hany is instructor of math2.   -Gamal is instructor of cs3.
-Samy is enrolled at cs3. -Aly is enrolled at math2.   -Saly is enrolled at cs3.

a) Facts; using the predicates: instructor and enrolled.

b) Rules; using the predicate teaches: Instructor teaches a Student if Instructor educate a course and the student is enrolled at the same course.

c) Write the following questions using Prolog syntax:

1) Find courses enrolled by student Aly.
2) List the names of the student's enrolled cs3.
3) Who teaches the student Samy
4) List the names of students who were taught by Instructor Gamal.

Q5: (10 Marks)

a) Use the Principle of Mathematical Induction to prove that:

$\sum_{i=1}^{n}(2i+3) = n(n+4)$ for all n ≥ 1.

b) Give a recursive algorithm for computing the greatest common divisor (gcd) of two nonnegative integers a and b with a<b. Trace the Algorithm when it finds gcd (8, 6).

"Good luck"   Dr.Eng. Mahmoud Abu Alfutuh

اجب عما يأتى:

السؤال الأول: (١٨ درجات)

(i) إثبت أن

$$\frac{\Gamma(2n)}{\Gamma(n)} = \frac{2^{2-1}}{\sqrt{\pi}} \Gamma(n + \frac{1}{2})$$

(ii) إثبت أن

$$\int_0^{\pi/2} [\frac{1}{\sin^3 \theta} - \frac{1}{\sin^2 \theta}]^{\frac{1}{4}} \cos\theta \, d\theta = \frac{[\Gamma(\frac{1}{4})]^2}{2\sqrt{\pi}}$$

السؤال الثانى: (٢١ درجة)

(i) أكتب صيغة رودرجز لدالة لاجندر ومن ثم إثبت أن $P_n(-x) = (-1^n)P_n(x)$

(ii) إثبت واحده فقط من العلاقات الأتية

$$J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x \quad , \qquad J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$$

ومن ثم إثبت أن

$$J_{\frac{3}{2}}(x) = \sqrt{\frac{2}{\pi x}}[\sin(x - \frac{\pi}{2}) + \frac{1}{x}\cos(x - \frac{\pi}{2})]$$

السؤال الثالث: (٢١ درجة)

(i) إثبت أن

$$\int_{-\infty}^{\infty} H_m(x)H_n(x)e^{-x^2} \, dx = \begin{cases} 0 & m \neq n \\ 2^n n! \sqrt{\pi} & m = n \end{cases}$$

(ii) أكتب صيغة رودرجز لدالة هرمت ومن ثم إثبت أن $H_n(-x) = (-1)^n H_n(x)$

(iii) أكتب الدالة المولده لدالة لاجير ومن ثم اثبت أن $L'_{n+1} = (n+1)[L'_n - L_n]$

السؤال الرابع: (١٨ درجة)

(i) إثبت أن

$$_2F_1(a,b;c;x) = \frac{1}{\beta(b,c-b)} \int_0^1 t^{b-1}(1-t)^{c-b-1}(1-xt)^{-a} \, dt$$

(ii) إثبت لأى دالة $f(x)$ المعادلة الأتية

$$\int_{-1}^{1} f(x)P_n(x)dx = \frac{(-1)^n}{2^n n!} \int_{-1}^{1} (x^2-1)^n \frac{d^n f(x)}{dx^n} dx$$

مع أطيب الأمنيات بالنجاح والتوفيق   د/ مجدى يوسف برسوم

Mansoura University		Artificial Intelligence
Faculty of Science		Final Term Exam June 2015 Time: 2 Hours

Question₁ [20 Points]

A. [10 Points] Identify which of the following statements are true or false.

1. Fully observable means that an agent's sensors give it access to the most state of the environment at each point in time.
2. Deterministic means that the next state of the environment is may be determined by the current state and the action executed by the agent.
3. The real world is modeled as a partially observable, deterministic, sequential, dynamic and multi-agent.
4. Problem solving agent is a type of goal based agent that only maps a sequence of condition action rules.
5. Uninformed search strategies known as a heuristic search that use only the information available in the problem definition.
6. Breadth first search strategy implemented as LIFO structure.
7. A* search act like greedy best first search in such way the both use g(n) in its evaluation.
8. If $h2(n) \geq h1(n)$ for all n (both admissible), then h2 dominates h1 and worst for search.
9. Neural networks can characterized by its structure, training algorithm and activation function.
10. Forward chaining is data driven, while backward chaining is goal driven strategy.

B. [10 Points] Redraw the following table after filling its blanks

Algorithm Criteria	BFS	DFS	DLS	Bidirectional	Greedy Best First
Completeness?					
Time Complexity					
Space Complexity					
Optimality?					

Question₂ [30 Points] Given the start and goal states of 8-Buzzle problem, Answer the following questions:

7	2	4
5		6
8	3	1

Start State

	1	2
3	4	5
6	7	8

Goal State

1. [5 Points] Formulate the 8-Buzzle problem.

2. [5 Points] Specify the environment of 8-Buzzle problem.

3. [10 Points] Use uniformed search strategies; BFS, DFS, and Bidirectional search to find the path from the start state until the goal state.

4. [10 Points] Use A* informed search strategy to find the optimal path from the start state until the goal state (use suitable heuristic function).

Question₃ [10 Points] Given the following knowledge base:

$$KB: (B1,1 \Longleftrightarrow (P1,2 \vee P2,1)) \wedge \neg B1,1))$$

Use resolution algorithm to prove that ¬P1,2 is valid

Good Luck

Dr.Osama Abu El-Nasr