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tute of Studies & Statistical Research

ations Research Department

جامعة القاهرة

معهد الدراسات و البحوث الإحصائية

قسم بحوث العمليات

البرمجة غير الخطية (٢)

Final Written Examination

pt to solve the following questions . Show your works so that partial credit may be assigned :

Solve the following unconstrained nonlinear programming problem :

Max $f(x,y) = (6 + x + y)^2 + (2 - 3x - 3y - xy)^2$ (4 marks)

Discuss the convexity of the following function :

(i) $f(x) = \dfrac{x + 2y}{2x + y}$ (ii) $f(x) = x^2 + 6y^2 - 4xy$ (4 marks)

Solve $\sin x = 1 + x^3$ by Newton – Raphson method . (4 marks)

Determine roots of the following system of nonlinear equations :

$x^2 + xy = 10,$

$y + 3xy^2 = 57.$

Using the multiple – equation Newton – Raphson method .

Note that a correct pair of roots is $x = 2$ and $y = 3$. Initiate the computation with guessses of $x = 1.5$ and $y = 3.5$. (4 marks)

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olve the following constrained nonlinear programming problem :

Max $f(x,y) = 7x^2 - 6x + 5y^2$

s . t .

$x + 2y \leq 10$; $x - 3y \leq 9$; $x, y \geq 0$.

(i) Graphically .

(ii) Using the Kuhn – Tucker conditions . (8 marks)

Define what is meant by : " Convex set " , " Exterme point " and " Convex function " . (3 marks)

Prove that the epigraph of the convex function and the hypograph of the concave function are convex sets . (5 marks)

A financial advisor must recommend a portfolio consisting of two investments to a client having LE . 15000 to invest . One investment returns 20 percent every other year , while the second investment returns 30 percent every third year . Determine the best investment mix for the portfolio if the client 's only stipulation is that the combined , yearly , expected return vary as little as possible . The relevant data for each investment are :

	Years					
	1	2	3	4	5	6
Investment 1	0	20	0	20	0	20
Investment 2	0	0	30	0	0	30

(8 marks)

With Best Wishes

Cairo University
Institute of Studies & Statistical Research
Operations Research Department

جامعة القاهرة
معهد الدراسات و البحوث الإحصائية
قسم بحوث العمليات

Course Name : Non linear Programming II	Term : 2nd term 2012
Course Code : OR 526	Date :19 / 6 / 2012
Examiner : Dr . Hamiden . A. Khalifa	Time Allowed : 3 hours

البرمجة غير الخطية (٢)
Final Written Examination

Attempt to solve the following questions . Show your works so that partial credit may be assigned :

1.a) Solve the following unconstrained nonlinear programming problem :

Max $f(x, y) = (6 + x + y)^2 + (2 - 3x - 3y - xy)^2$ (4 marks)

b) Discuss the convexity of the following function :

(i) $f(x) = \dfrac{x + 2y}{2x + y}$ (ii) $f(x) = x^2 + 6y^2 - 4xy$ (4 marks)

2.a) Solve $\sin x = 1 + x^3$ by Newton – Raphson method . (4 marks)

b) Determine roots of the following system of nonlinear equations :

$x^2 + xy = 10,$

$y + 3xy^2 = 57.$

Using the multiple – equation Newton – Raphson method .
Note that a correct pair of roots is $x = 2$ and $y = 3$. Initiate the computation with guessses of $x = 1.5$ and $y = 3.5.$ (4 marks)

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3) Solve the following constrained nonlinear programming problem :

Max $f(x, y) = 7x^2 - 6x + 5y^2$

s . t .

$x + 2y \le 10$; $x - 3y \le 9$; $x, y \ge 0$.

(i) Graphically .
(ii) Using the Kuhn – Tucker conditions . (8 marks)

4.a) Define what is meant by : " Convex set " , " Exterme point " and " Convex function " . (3 marks)

b) Prove that the epigraph of the convex function and the hypograph of the concave function are convex sets . (5 marks)

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5) A financial advisor must recommend a portfolio consisting of two investments to a client having LE . 15000 to invest . One investment returns 20 percent every other year , while the second investment returns 30 percent every third year . Determine the best investment mix for the portfolio if the client 's only stipulation is that the combined , yearly , expected return vary as little as possible . The relevant data for each investment are :

	Years					
	1	2	3	4	5	6
Investment 1	0	20	0	20	0	20
Investment 2	0	0	30	0	0	30

(8 marks)

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