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NPTEL

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Unit 3 - Week-2

Course outline

How to access the portal

Week-1

Week-2

- Lesson-6 KKT optimality conditions
- Lesson-7 Quadratic Programming Problems-I
- Lesson-8 Quadratic Programming Problems -II
- Lesson-9 Separable Programming-I
- Lesson-10 Separable Programming-II
- Quiz : Assignment 2
- Solution of Assignment-2

Week-3

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WEEKLY FEEDBACK

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Assignment 2

The due date for submitting this assignment has passed. **Due on 2018-09-12, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *Consider the QPP* ***1 point***

$(\mathbf{P})$ Min $Z = c^T x + x^T Q x$
$s/t \;\; Ax \leq b,$
$x \geq 0.$
where $x, c \in \mathbb{R}^2$ *and* $b \in \mathbb{R}$.
If the KKT conditions of the problem $(\mathbf{P})$ *are*

$$\begin{pmatrix} 2 & -2 & 2 & -1 & 0 & 0 \\ -2 & 4 & 1 & 0 & -1 & 0 \\ 2 & 1 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \lambda_1 \\ \mu_1 \\ \mu_2 \\ s_1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$x_1, x_2, \lambda_1, \mu_1, \mu_2, s_1 \geq 0, \; \lambda_1 s_1 = \mu_1 x_1 = \mu_2 x_2 = 0.$
Then the problem $(\mathbf{P})$ *is*

- $Min\ z = x_1 + x_2 - x_1^2 + 2x_1x_2 - 2x_2^2$
  $s/t\ 2x_1 + x_2 \leq 1,$
  $x_1, x_2 \geq 0.$
- $Min\ z = -x_1 - x_2 + x_1^2 - 2x_1x_2 + 2x_2^2$
  $s/t\ 2x_1 + x_2 \leq 1,$
  $x_1, x_2 \geq 0.$
- $Min\ z = x_1 + x_2 + 2x_1^2 + 2x_1x_2 - 2x_2^2$
  $s/t\ 2x_1 + x_2 \leq 1,$
  $x_1, x_2 \geq 0.$
- $Min\ z = -x_1 - x_2 - x_1^2 + 2x_1x_2 - 2x_2^2$
  $s/t\ x_1 + 2x_2 \leq 1,$
  $x_1, x_2 \geq 0.$

No, the answer is incorrect

2) *The KKT conditions for the problem* **1 point**

$Min\ z = 3x_1^2 + 2x_2^2 - 2x_1x_2 - 2x_1 - 3x_2,$
$s/t\ 3x_1 + 4x_2 \leq 12,$
$x_1, x_2 \geq 0$
are
$\alpha x_1 - 2x_2 + 3\lambda_1 - \mu_1 = \beta,$
$-2x_1 + \gamma x_2 + 4\lambda_1 - \mu_2 = 3,$
$3x_1 + 4x_2 + s_1 = 12,$
$\lambda_1 s_1 = x_1\mu_1 = x_2\mu_2 = 0,$
$all\ \ variables\ \geq 0.$
Then $\alpha + \beta + \gamma$ *equals*

- 3
- 6
- 12
- 13

No, the answer is incorrect.
Score: 0

Accepted Answers:
12

3) *By* $Wolfe's$ *method, the optimal value of the* QPP : **1 point**

$Min\ Z = 2x_1^2 + 2x_2^2 - 4x_1 - 4x_2,$
$s/t\ 2x_1 + 3x_2 \leq 6,$
$x_1, x_2 \geq 0$
is

- -8
- -4
- 0
- 5

No, the answer is incorrect.
Score: 0

Accepted Answers:
-4

4) Which one of the following is a convex quadratic programming problem: **1 point**

- $Max\ z = 2x_1^2 + 4x_1x_2 + 6x_2^2 - 4x_1 - 8x_2,$
  $s/t\ \ 2x_1 + 3x_2 \leq 6,$
  $\$ \quad x_1, x_2 \geq 0.$
- $Min\ z = x_1^2 - x_1x_2 + 4x_2^2 + x_1 + 2x_2,$
  $s/t\ \ x_1^2 + x_2^2 \leq 1,$
  $x_1, x_2 \geq 0.$
- $Max\ z = -x_1^2 - x_1x_2 - 4x_2^2 + x_1 + 2x_2,$
  $s/t\ \ 2x_1 + 3x_2 \leq 1,$
  $x_1, x_2 \geq 0.$
- $Min\ z = x_1^2 + x_2^2,$
  $s/t\ x_1 + x_2^2 = 1,$
  $x_1, x_2 \geq 0.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$Max\ z = -x_1^2 - x_1x_2 - 4x_2^2 + x_1 + 2x_2,$
$s/t\ \ 2x_1 + 3x_2 \leq 1,$
$x_1, x_2 \geq 0.$

5) Which of the following can be expressed as separable programming problem: ***1 point***

$\max z = x_1^3 + x_2^2 + 2x_2x_3 + x_3^2,$
$s/t\ \ x_1 + x_3 \leq 1,$
$x_1, x_2, x_3 \geq 0.$

$\max\ z = x_1x_2^3x_3^2,$
$s/t\ \ \dfrac{x_1}{x_2} + x_3 \leq 12,$
$x_1, x_2 > 0.$

$\min\ z = x_1^3 + x_2 + x_3,$
$\dfrac{x_1}{x_2x_3} \leq 5,$
$x_1, x_2 > 0.$

$\min z = x_1 + x_2^2 + 2x_2$
$e^{x_1x_2} \geq 7,$
$x_1, x_2 > 0.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\min z = x_1 + x_2^2 + 2x_2$
$e^{x_1x_2} \geq 7,$
$x_1, x_2 > 0.$

6) *The KKT conditions for the QPP of the form* ***1 point***

$\min z = c^Tx + x^TQx$
$s/t\ Ax \leq b,$
$x \geq 0.$
will be sufficient if

$Q\ is\ negative\ semi - definite$

$Q\ is\ positive\ semi - definite$

$Q + Q^T\ is\ positive\ semi - definite$

$Q - Q^T\ is\ positive\ semi - definite$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$Q\ is\ positive\ semi - definite$

7) ***1 point***

For the separable programming problem
$Max\ \ f = 3x_1^4 + 2x_2 + 1,$
$s/t\ \ 4x_1^2 + 9x_2^2 \leq 36,$
$x_1, x_2 \geq 0,$
the lower and upper bounds of the variables x_1 *and* x_2 *are*

- $0 \leq x_1 \leq 4,\ 0 \leq x_2 \leq 9$
- $0 \leq x_1 \leq 3,\ 0 \leq x_2 \leq 3$
- $0 \leq x_1 \leq 2,\ 0 \leq x_2 \leq 2$
- $0 \leq x_1 \leq 3,\ 0 \leq x_2 \leq 2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$0 \leq x_1 \leq 3,\ 0 \leq x_2 \leq 2$

8) *1 point*

Consider the following problem :
$Min\ z = x_1^4 + x_2^2 - 2x_1 - 4x_2$
$s/t\ 2x_1 + x_2^2 \leq 4,$
$x_1, x_2 \geq 0.$*Let the grid points for* x_1 *and* x_2 *be* $0, 1, 2.$
Then, the linear approximation of the constraint, using weights in terms of $\lambda_i's\ (i = 1, 2, 3)$ *for* x_1 *and in terms of* $\mu_i's\ (i = 1, 2, 3)$ *for* x_2, *is*

- $\lambda_1 + \lambda_2 + \lambda_3 + \mu_1 + \mu_2 + \mu_3 \leq 1$
- $2\lambda_1 + 4\lambda_2 + \mu_1 + 4\mu_2 \leq 4$
- $\lambda_2 + \lambda_3 + \mu_2 + \mu_3 \leq 4$
- $2\lambda_2 + 4\lambda_3 + \mu_2 + 4\mu_3 \leq 4$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2\lambda_2 + 4\lambda_3 + \mu_2 + 4\mu_3 \leq 4$

9) *If using* $KKT - conditions$, *the optimal solution of the problem* *1 point*
$Min\ z = 2x_1^2 + x_2^2 - 2x_1x_2 - 5x_1 - 2x_2,$
$s/t\ 3x_1 + 2x_2 \leq 20,$
$x_1, x_2 \geq 0.$
is $(\alpha, 4.5)$, *then* α *equals*

- 1
- 3.5
- 4
- 4.5

No, the answer is incorrect.
Score: 0

Accepted Answers:
3.5

10) **1 point**

$Using\ separable\ programming\ technique,\ the\ optimal\ value\ of\ the\ problem Max\ f = x_1 -$
$s/t\ 3x_1^2 + 2x_2^2 \leq 9,$
$x_1, x_2 \geq 0.$
is

- $\frac{9}{10}$
- 9
- $\frac{45}{2}$
- 45

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{45}{2}$

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