Quiz 3

Due Apr 14 at 11:59pm **Points** 14 **Questions** 14 **Available** Apr 6 at 12am - Apr 18 at 11:59pm 13 days **Time Limit** 60 Minutes

Instructions

Answer the following multiple choice questions.

This quiz is no longer available as the course has been concluded.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	40 minutes	13 out of 14

Score for this quiz: **13** out of 14
Submitted Apr 14 at 9:10pm
This attempt took 40 minutes.

Question 1

1 / 1 pts

Given the optimization problem:

$$\begin{array}{ll} \min & x_1^2 + 2x_1 \\ \text{s.t.} & 3x_1 + 1 \leq 0 \end{array}$$

which of the following expressions is the correct quadratic penalty function formulation?

- $3x_1 + 1 + \frac{\rho}{2}(x_1^2 + 2x_1)^2$
- Correct! $x_1^2 + 2x_1 + \frac{\rho}{2}(3x_1 + 1)^2$
- $x_1^2 + 2x_1 - \frac{\rho}{2}(3x_1 + 1)^2$
- $3x_1 + 1 - \frac{\rho}{2}(x_1^2 + 2x_1)^2$

Question 2

1 / 1 pts

Given the optimization problem:

$$\begin{array}{ll} \min & x_1^2 + 2x_1 \\ \text{s.t.} & 3x_1 + 1 \leq 0 \end{array}$$

which of the following expressions is the correct log-barrier penalty function formulation?

- $x_1^2 + 2x_1 - \frac{\mu}{-3x_1 - 1}$
- $x_1^2 + 2x_1 - \mu \ln(3x_1 + 1)$
- Correct! $x_1^2 + 2x_1 - \mu \ln(-3x_1 - 1)$
- $x_1^2 + 2x_1 + \mu \ln(3x_1 + 1)$

Question 3 **1 / 1 pts**

For a constrained optimization problem in which there are active constraints, the quadratic penalty function solution has the following properties:

- The solution of the penalty problem approaches the true constrained solution as the penalty parameter decreases. The unconstrained solution approaches the true solution from the feasible space.
- The solution of the penalty problem approaches the true constrained solution as the penalty parameter increases. The unconstrained solution approaches the true solution from the feasible space.
- Correct! The solution of the penalty problem approaches the true constrained solution as the penalty parameter increases. The unconstrained solution approaches the true solution from the infeasible space.
- The solution of the penalty problem approaches the true constrained solution as the penalty parameter decreases. The unconstrained solution approaches the true solution from the infeasible space.

Question 4 **1 / 1 pts**

For a constrained optimization problem in which there are active constraints, the log-barrier function solution has the following properties:

- Correct! The solution of the log-barrier problem approaches the true constrained solution as the barrier parameter decreases. The unconstrained solution approaches the true solution from the feasible space.
- The solution of the log-barrier problem approaches the true constrained solution as the barrier parameter decreases. The unconstrained solution approaches the true solution from the infeasible space.
- The solution of the log-barrier problem approaches the true constrained solution as the barrier parameter increases. The unconstrained solution approaches the true solution from the infeasible space.
- The solution of the log-barrier problem approaches the true constrained solution as the barrier parameter increases. The unconstrained solution approaches the true solution from the feasible space.

Question 5 **1 / 1 pts**

The augmented Lagrangian penalty method, with sufficiently accurate multiplier estimates, is an example of

- An interior point method
- An inexact penalty method
- A direct penalty method
- Correct! An exact penalty method

Question 6

1 / 1 pts

The ℓ_1 penalty function is

Correct!

- (selected) An exact penalty function that is not differentiable
- A direct penalty function that is smooth
- An exact penalty function that is smooth
- An inexact penalty function

Question 7

1 / 1 pts

Consider the optimization problem

$$\begin{array}{ll} \textbf{min} & 3x_1 + 1 \\ \textbf{s.t.} & -x_1 - 1 \leq 0 \end{array}$$

The constrained minimizer is at $x_1 = -1$with a multiplier of $\lambda_1 = 3$.

Using a quadratic penalty function formulation, the unconstrained minimizer is

- $1 + \frac{4}{\rho}$
- $-\frac{4}{\rho}$

Correct!

- (selected) $-1 - \frac{3}{\rho}$
- $-1 + \frac{3}{\rho}$

Question 8

1 / 1 pts

Consider the optimization problem

$$\begin{array}{ll} \textbf{min} & 3x_1 + 1 \\ \textbf{s.t.} & -x_1 - 1 \leq 0 \end{array}$$

The constrained minimizer is at $x_1 = -1$with the multiplier $\lambda_1 = 3$.

Using a log barrier penalty function, the unconstrained solution is

Correct!

- (selected) $-1 + \frac{\mu}{3}$
- $-1 - \frac{\mu}{3}$
- $-1 + \frac{3}{\mu}$
- $-1 - 3\mu^2$

Question 9

0 / 1 pts

Full-space methods are a formulation for simulation-based optimization problems best described as:

- Including both the design variables and state variables in the optimization problem formulation. The governing equations are ignored.

You Answered

- Including only the design variables in the optimization problem formulation. The governing equations are included as a set of equality constraints.

- Including only the state variables in the optimization problem formulation. The governing equations are included as a set of equality constraints.

Correct Answer

- Including both the design variables and state variables in the optimization problem formulation. The governing equations are included as a set of equality constraints.

Question 10

1 / 1 pts

The reduced space method handles the state variables associated with the governing equations in the following manner:

- Considering the state variables as independent variables along with the design variables. The governing equations are satisfied at each new design point by appending them as equality constraints.

Correct!

- Considering the state variables as an implicit function of the design variables. The governing equations are satisfied at each new design point.

- Considering both state and design variables as independent. The governing equations are never satisfied.

- Considering the state variables as an implicit function of the design variables, however the governing equations are only satisfied at the final, optimized design point.

Question 11

1 / 1 pts

Finite-difference methods suffer from subtractive cancellation and truncation error. These errors are best described as follows:

- Truncation errors occur due to floating point arithmetic. Subtractive cancellation arises due to Taylor series approximations.

- Subtractive cancellation and truncation error both decrease as the step size decreases. It is good practice to select a very small step size for finite-difference computations.

Correct!

- Subtractive cancellation increases as the step size decreases while truncation error decreases as the step size decreases. Both errors cannot be eliminated simultaneously.

- It's best to use matlab so that you avoid subtractive cancellation and truncation errors.

Question 12

1 / 1 pts

The complex-step method can provide accurate derivative estimates since

Correct!

- (selected) It does not suffer from subtractive cancellation so very small step sizes can be used to reduce truncation error.
- Complex types can represent small numbers better than real types.
- It does not use finite-precision arithmetic.
- It does not suffer from truncation error so very small step sizes can be used to reduce subtractive cancellation.

Question 13

1 / 1 pts

Algorithmic differentiation can provide accurate derivatives by

Correct!

- (selected) Systematically applying the chain rule to all the operations in a simulation code, thereby providing the derivative of outputs with respect to inputs.
- Using extended precision arithmetic to avoid subtractive cancellation.
- Systematically applying finite-difference methods throughout a simulation code to provide the required derivatives.
- Emulating your simulation on a virtual machine using matlab.

Question 14

1 / 1 pts

The adjoint method provides an efficient way to compute the derivative of an output quantity of interest with respect to the design variables within the context of a reduced-space design optimization formulation. The steps involved in the adjoint are best described as:

- Compute the partial derivatives of the function of interest using finite-difference methods, then assemble the total derivative.
- Solve the direct sensitivity equations to obtain the matrix of adjoint variables. This adjoint matrix is independent of the function of interest.

Correct!

- (selected) Solve the adjoint equations to obtain the adjoint variables, and use the adjoint variables to compute the total derivative. The adjoint equations are always linear in the adjoint variables.
- Solve the nonlinear adjoint equations to obtain the adjoint variables. Use the solution to compute the total derivative.

Quiz Score: **13** out of 14