FM5031 Practitioner's Course
Quantitative Risk Management
Week 8 Quiz

Name/Id: ______________________________

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This is the last of six quizzes for my module. The bottom score will be eliminated. This quiz will last about twenty minutes. You are welcome to use any notes or texts. This quiz should represent your individual effort. Do not seek or offer assistance to your classmates.

Instructions: Choose the single most correct answer to each of the problems below.

1. Let Ω be the sample space of risk factors, $\mathcal{M}$ be the set of almost surely finite random variables representing the loss, $\mathcal{F}$ be the collection of measurable sets on Ω, and $\mathcal{S}^1$ be the set of possible probability measures. The acceptance set A_ϱ for a risk measure $\varrho(L)$ where $L \in \mathcal{M}$ is a subset of

   (a) potential probability measures $\mathcal{S}^1$.

   $\boxed{\text{(b)}}$ potential losses $\mathcal{M}$.

   (c) potential risk factor outcomes Ω.

2. Distortion risk measures are inherently

   (a) coherent.

   (b) comonotone additive.

   $\boxed{\text{(c)}}$ coherent and comonotone additive.

3. For loss that is linear in elliptical risk factors, the stress test set is defined by

$$S_\varrho = \left\{ \boldsymbol{x} : (\boldsymbol{x} - \boldsymbol{\mu})' \Sigma^{-1} (\boldsymbol{x} - \boldsymbol{\mu}) \leq \varrho\,(Y_1)^2 \right\}$$

   where $\boldsymbol{Y} = (Y_1, Y_2, \ldots)'$ is the spherical version of the risk factors $\boldsymbol{X}$, as long as $\varrho\,(Y_1) > 0$ and

   $\boxed{\text{(a)}}$ the risk factor dispersion matrix is invertible.

   (b) the risk factor correlations are all positive.

   (c) the risk factor means are zero.

4. In the context of capital allocation by gradient of a coherent risk measure, $\varrho\,(L_1 + L_2 + \cdots) = AC_1^\varrho + AC_2^\varrho + \cdots \leq \varrho\,(L_1) + \varrho\,(L_2) + \cdots$, it is generally true that

   (a) $\frac{\varrho(L_1)}{\varrho(L_1+L_2+\cdots)} + \frac{\varrho(L_2)}{\varrho(L_1+L_2+\cdots)} + \cdots = 1$

   (b) $\varrho\,(L_1) \leq AC_1^\varrho$

   $\boxed{\text{(c)}}$ $AC_1^\varrho \leq \varrho\,(L_1)$

5. When the loss random variable $L \in \mathcal{M}$ is linear in risk factors that are jointly elliptical and has finite variance, any coherent risk measure can be expressed as $\varrho(L) = r_\varrho(\boldsymbol{\lambda}) = \mathrm{E}\, L + k_\varrho \sqrt{\operatorname{var} L}$ for some $k_\varrho \geq 0$. Say $k_\varrho > 0$ and consider all portfolios with a particular expected profit Π, $\Lambda_\Pi = \{\boldsymbol{\lambda} : \mathrm{E}\, L = -\Pi\}$. The optimal portfolio(s) in this setting is defined by

   $\boxed{\text{(a)}}$ $\arg\min_{\boldsymbol{\lambda} \in \Lambda_\Pi} \operatorname{var} L(\boldsymbol{\lambda})$

   (b) $\arg\max_{\boldsymbol{\lambda} \in \Lambda_\Pi} \operatorname{var} L(\boldsymbol{\lambda})$

   (c) $\arg\max_{\boldsymbol{\lambda} \in \Lambda_\Pi} r_\varrho(\boldsymbol{\lambda})$