

Released: Monday, June 8
 Due: Friday, June 12 at 5 pm CST

Problem 1:	/	20
Problem 2:	/	10
Problem 3:	/	25
Problem 4:	/	25
Problem 5:	/	20
Total:	/	100

Equations you may find useful:

$$1 = \int_{-\infty}^{\infty} dx \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

$$\sigma^2 = \int_{-\infty}^{\infty} dx \frac{(x-\mu)^2}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

$$S = k_B \ln \Omega$$

$$\beta = \frac{1}{k_B T} = \frac{1}{k_B} \left(\frac{\partial S}{\partial E} \right)_{N,V}$$

$$Q(\beta) = \sum_{\nu} e^{-\beta E(\nu)} \quad [\text{Canonical}]$$

$${}_M C_N = \frac{M!}{N!(M-N)!}$$

$$\mu = \int_{-\infty}^{\infty} dx \frac{x}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$$

$$P(\nu) = \frac{e^{-\beta E(\nu)}}{Q(\beta)} \quad [\text{Canonical}]$$

$$-\beta A = \ln Q \quad [\text{Canonical}]$$

$$C_V = \left(\frac{\partial \langle E \rangle}{\partial T} \right)_{N,V}$$

$$\ln n! \approx n \ln n - n$$

$$dE = TdS - pdV + \mu dN$$

$$A = E - TS$$

Instructions: This take-home exam must be completed without collaborating with others. You may use course notes (official posted notes or notes you took), your problem set solutions, the official posted problem set solutions, and the videos of lectures. You may not use textbooks or the internet.

In an in-class setting, I would allocate two hours for this exam, meaning I think you could solve the majority of the problems in that time if you had studied carefully and worked diligently for two uninterrupted hours. You may wish to take the exam in that fashion or you may choose to intersperse your studying with your problem solving, treating the exam more like a non-collaborative problem set. If you choose the latter, I expect the exam to fill a similar amount of time as the problem sets did.

Office hours will be held this week at the ordinary time. Given the extraordinary circumstances of this quarter and the P/NP grading scheme, I will even entertain well-prepared exam-related questions. If you're willing to put in the time and effort to precisely identify your points of confusion, I'm willing to help.

This course has ended, so the exams and solutions have been removed. If you have a good reason to want access, please email Todd.