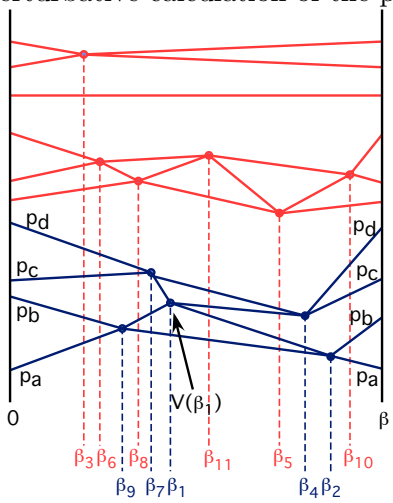
Physics 831 Quiz #10 - Friday, Nov. 9

YOUR NAME:_____

1. The diagram represents a perturbative calculation of the partition function.



Consider the connected diagram involving $p_a \to p_d$ which when used to calculate the pressure contributes at order n in perturbation theory and to to order m in powers of $e^{\beta\mu}$, i.e., the prefactor is $e^{m\beta\mu}$. Circle one of the below:

$n=4, m=4$	$n=4, m=5$	$n=4, m=12$
$n=5, m=4$	$n=5, m=5$	$n=5, m=12$
$n=12, m=4$	$n=12, m=5$	$n=12, m=12$

none of the above

2. Consider a virial expansion for a non-relativistic two-dimensional gas of spin-zero bosons of mass m at temperature T,

$$\frac{P}{\rho T} = 1 + \sum_{m=2}^{\infty} A_m \left(\frac{\rho}{\rho_0}\right)^{m-1}, \qquad \rho_0 \equiv \frac{mT}{2\pi\hbar^2}.$$

Ignoring interactions between the particles, calculate A_2.

3. Consider two states:

$$|\alpha\rangle = e^{\alpha a^\dagger}|0\rangle, \qquad |\beta\rangle = e^{\beta a^\dagger}|0\rangle.$$

Find the overlap, $\langle\alpha|\beta\rangle$.