Unit 10 - Week 8

Assessment 8

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

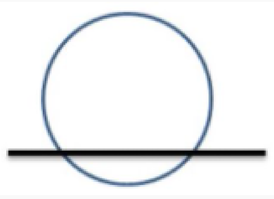
Due on 2020-11-11, 23:59 IST.

1) The action for a φ^4 field in *0-D* spacetime is $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$. The Schwinger Dyson equation for the field function $\phi(J)$ is: *1 point*

- $\phi(J)=\frac{J}{\mu}-\frac{\lambda_4}{6\mu}\left[\phi(J)^3+3\phi(J)\frac{\partial}{\partial J}\phi(J)+\frac{\partial^2}{(\partial J)^2}\phi(J)\right]$
- $\phi(J)=\frac{J}{\mu}+\frac{\lambda_4}{6\mu}\left[\phi(J)^3+3\phi(J)\frac{\partial}{\partial J}\phi(J)-\frac{\partial^2}{(\partial J)^2}\phi(J)\right]$
- $\phi(J)=\frac{J}{\mu}+\frac{\lambda_4}{6\mu}\left[\phi(J)^3+3\phi(J)\frac{\partial}{\partial J}\phi(J)+\frac{\partial^2}{(\partial J)^2}\phi(J)\right]$
- $\phi(J)=\frac{J}{\mu}-\frac{\lambda_4}{6}\left[\phi(J)^3+3\phi(J)\frac{\partial}{\partial J}\phi(J)+\frac{\partial^2}{(\partial J)^2}\phi(J)\right]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\phi(J)=\frac{J}{\mu}-\frac{\lambda_4}{6\mu}\left[\phi(J)^3+3\phi(J)\frac{\partial}{\partial J}\phi(J)+\frac{\partial^2}{(\partial J)^2}\phi(J)\right]$

2) The following Feynman diagram in context of φ^4 theory with the action $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$ in *0-D* spacetime evaluates to: *1 point*



- $\frac{1}{2^2}\frac{\lambda_4^2}{\mu^3}$
- $\frac{1}{2!}\frac{\lambda_4}{\mu^3}$
- $\frac{1}{2^3}\frac{\lambda_4^2}{\mu^3}$
- $\frac{1}{3!}\frac{\lambda_4^2}{\mu^5}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{3!}\frac{\lambda_4^2}{\mu^5}$

3) The Schwinger Dyson equation for the generating functional for the full Green's functions *Z(J)* for the φ^4 theory with the action $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$ in *0-D* spacetime in the loop expansion parameter $\hbar$ evaluates to: *1 point*

- $\frac{\lambda_4}{2}\hbar^3Z'''(J)+\mu^2\hbar Z'(J)-JZ(J)=0$
- $\lambda_4\hbar^3Z'''(J)+\hbar Z'(J)-JZ(J)=0$
- $\hbar^3Z'''(J)+\mu\hbar Z'(J)-JZ(J)=0$
- $\frac{\lambda_4}{6}\hbar^3Z'''(J)+\mu\hbar Z'(J)-JZ(J)=0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\lambda_4}{6}\hbar^3Z'''(J)+\mu\hbar Z'(J)-JZ(J)=0$

4) Consider a field theory on *1-D* spacetime continuum. The propagator has the expression: *1 point*

- $\Pi(x)=\frac{1}{2\pi}\int\frac{\exp(-ixk)}{k^2-m^2}dk$
- $\Pi(x)=\frac{1}{2\pi}\int\frac{\exp(ixk)}{k^2-m^2}dk$
- $\Pi(x)=\frac{1}{2\pi}\int\frac{\exp(ixk)}{k^2+m^2}dk$
- $\Pi(x)=\frac{1}{2\pi}\int\frac{\exp(-ixk)}{k^2+m^2}dk$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Pi(x)=\frac{1}{2\pi}\int\frac{\exp(ixk)}{k^2+m^2}dk$

5) Consider a field theory on 1 dimensional spacetime continuum. The expression for the action (with sources) is: *1 point*

- $S[\boldsymbol{\varphi},J]=\int\left[\frac{1}{2}m^2\boldsymbol{\varphi}(x)^2-\frac{1}{2}\boldsymbol{\varphi}'(x)^2-J(x)\boldsymbol{\varphi}(x)\right]dx$
- $S[\boldsymbol{\varphi},J]=\int\left[\frac{1}{2}m^2\boldsymbol{\varphi}(x)^2+\frac{1}{2}\boldsymbol{\varphi}'(x)^2-J(x)\boldsymbol{\varphi}(x)\right]dx$
- $S[\boldsymbol{\varphi},J]=\int\left[-\frac{1}{2}m^2\boldsymbol{\varphi}(x)^2+\frac{1}{2}\boldsymbol{\varphi}'(x)^2-J(x)\boldsymbol{\varphi}(x)\right]dx$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$S[\boldsymbol{\varphi},J]=\int\left[\frac{1}{2}m^2\boldsymbol{\varphi}(x)^2+\frac{1}{2}\boldsymbol{\varphi}'(x)^2-J(x)\boldsymbol{\varphi}(x)\right]dx$

6) Consider a φ^4 field theory on *D* dimensional Euclidean spacetime continuum with a source *J*. The Euler-Lagrange equation gives us: *1 point*

- $m^2\boldsymbol{\varphi}(\vec{x})-\vec{\nabla}^2\boldsymbol{\varphi}(\vec{x})+\frac{\lambda_4}{3!}\boldsymbol{\varphi}(\vec{x})^3=J(\vec{x})$
- $m^2\boldsymbol{\varphi}(\vec{x})-\vec{\nabla}^2\boldsymbol{\varphi}(\vec{x})+\frac{\lambda_4}{4!}\boldsymbol{\varphi}(\vec{x})^4=J(\vec{x})$
- $m^2\boldsymbol{\varphi}(\vec{x})+\vec{\nabla}^2\boldsymbol{\varphi}(\vec{x})+\frac{\lambda_4}{4!}\boldsymbol{\varphi}(\vec{x})^4=J(\vec{x})$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$m^2\boldsymbol{\varphi}(\vec{x})-\vec{\nabla}^2\boldsymbol{\varphi}(\vec{x})+\frac{\lambda_4}{3!}\boldsymbol{\varphi}(\vec{x})^3=J(\vec{x})$

7) The action for a φ^4 field in *0-D* spacetime is $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$. The Schwinger Dyson equation corresponding to the tree diagram is given by: *1 point*

- $\mu\phi^{tr}(J)+\frac{\lambda_4}{6}\phi^{tr}(J)^3=J\phi^{tr}(J)$
- $\frac{1}{2}\mu\phi^{tr}(J)^2+\frac{\lambda_4}{4!}\phi^{tr}(J)^4-J=0$
- $\mu\phi^{tr}(J)+\frac{\lambda_4}{6}\phi^{tr}(J)^3-J=0$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mu\phi^{tr}(J)+\frac{\lambda_4}{6}\phi^{tr}(J)^3-J=0$

8) The action for a φ^4 field in *0-D* spacetime is $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$. The equation for the saddle point is: *1 point*

- $\mu\phi_0(J)+\frac{\lambda_4}{6}\phi_0(J)^3=J\phi_0(J)$
- $\frac{1}{2}\mu\phi_0(J)+\frac{\lambda_4}{4!}\phi_0(J)^4-J=0$
- $\mu\phi_0(J)+\frac{\lambda_4}{6}\phi_0(J)^3-J=0$
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\mu\phi_0(J)+\frac{\lambda_4}{6}\phi_0(J)^3-J=0$

9) The action for a φ^4 field in *0-D* spacetime is $S[\varphi]=\frac{1}{2}\mu\varphi^2+\frac{1}{4!}\lambda_4\varphi^4$. In the saddle point approximation, *Z(J)* is: *1 point*

- a Gaussian
- a δ-function around φ_0, the saddle point
- a constant
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
a Gaussian

10) "Vacuum bubbles" are those Feynman diagrams that: *1 point*

- contain both external lines and source vertices
- contain only source vertices
- contain neither external lines nor source vertices
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
contain neither external lines nor source vertices