In the name of God

# Department of Physics
# Shahid Beheshti University

## ADVANCED METHODS ON COMPUTATIONAL PHYSICS

### Exercise Set 14

### (Date Due: 1399/03/25)

**1.** Finite element method: Consider the following boundary value problem:

$$-\frac{d^2\phi(x)}{dx^2} + \phi(x) = f(x), \qquad 0 < x < 1, \quad \phi(x=0) = \phi(x=1) = 0$$

**A**: Show that $\int_0^1 \frac{d\phi}{dx}\frac{d\psi}{dx}dx + \int_0^1 \phi\psi dx = \int_0^1 f\psi dx$.

**B**: Consider $\phi(x) = \sum \alpha_i u_i(x)$ in $x \in [0,1]$ with $\Delta x = 1/4$ and also use the base function same as that of introduced in class. write a program to solve the above equation using finite element method for $f(x) = 1$.

**C**: For $f(x) = \sin(x)$, write a program to solve the above equation using finite element method.

Good luck, Movahed