University of Annaba–"Departmant of Physics"

Master 2 in Theoretical Physics **Thursday, 26 January, 2012**

Exam 1

Numerical Analysis

Exercice 1. Consider the following second order elliptic equation:

$$-u_{xx}(x) + u(x) = x^2 - 1, \ x \in (0,1) \tag{1}$$

with

$$u(0) = u(1) = 0. \tag{2}$$

Suggest two schemes one is a finite difference and the other is a finite volume. Study the convergence of these two schemes.

Exercice 2. Consider the following parabolic equation (with a given $T > 0$):

$$u_t(x,t) - u_{xx}(x,t) + 2u(x,t) = x - t, \ (x,t) \in (0,1) \times (0,T), \tag{3}$$

with

$$u(0) = u(1) = 0 \tag{4}$$

and

$$u(x,0) = x. \tag{5}$$

Suggest two finite differnce schemes, one is explicit and the other is imlicit. Study the convergence of these two schemes.