King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

Math 572 , Term: 142 — Assignment (7)
Instructor: Dr. Faisal Fairag — Due Sunday 16/5/2015

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(1) Consider the problem $-\Delta u = 0$, $\Omega = (0,1)\times(0,1)$, $u = 0$ on $\partial\Omega$

(a) Write a Matlab file which Uses Two-Grid method to solve the linear system resulted from discretizing the above problem with uniform mesh. Use the meshsizes H = 0.2 and h = 0.1.

{Hint: you may use the matlab functions K = StiffMat2D(p,t) and L = LoadVec2D(p,t) to create the matrices. Another option is to use the following pdetoolbox lines to create your matrices

```
[p,e,t]=initmesh('lshapeg','hma',0.2); x=p(1,:); y=p(2,:);
[A,M]=assema(p,t,2,1,0); }
```

(b) solve the problem with differenet sets of meshsizes (e.g (H,h)=(0.2,0.1) , (H,h)=(0.1,0.05) , (H,h)=(0.02,0.0.1)) then calculate the order of convergence [use the A\b as the exact solution]

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(2) Modify the Matlab function [u] = V_Cycle(A,b,u,level) to do multigrid W-cycle

(a) Solve the given problem in the slide with the following multigrid components:

Smoother: GS
Number of pre-smoother : 4
Number of post-smoother ; 2
Number of levels : 3
Cycle Type: W