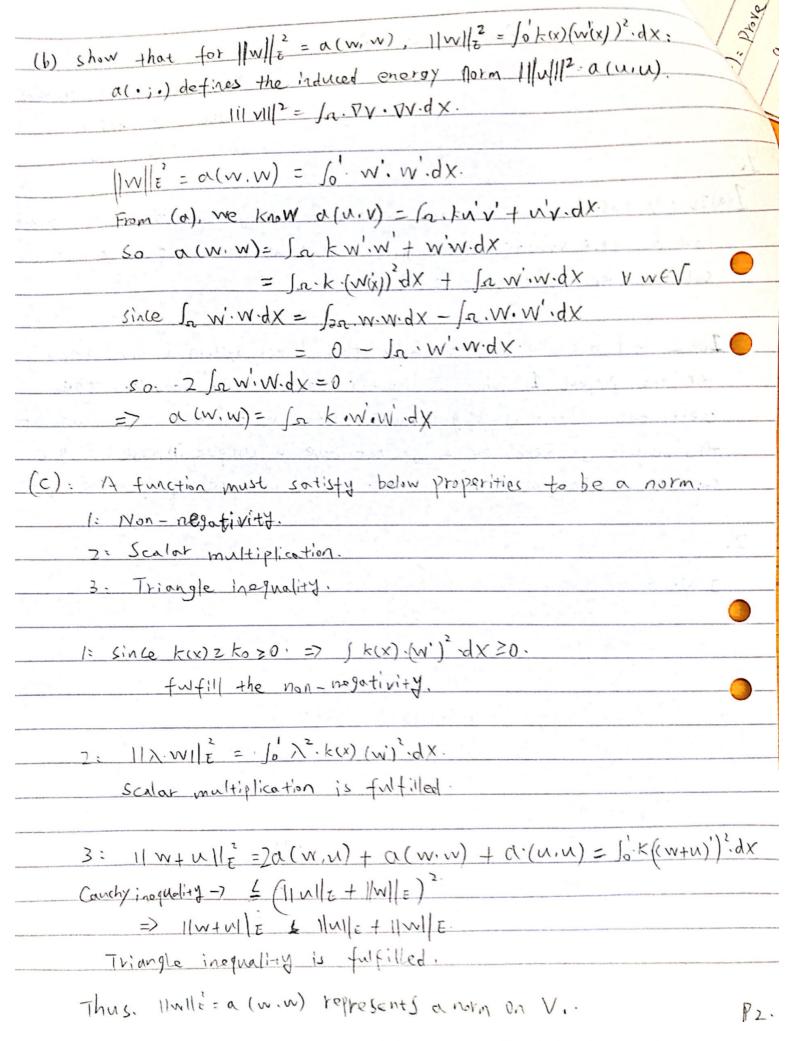
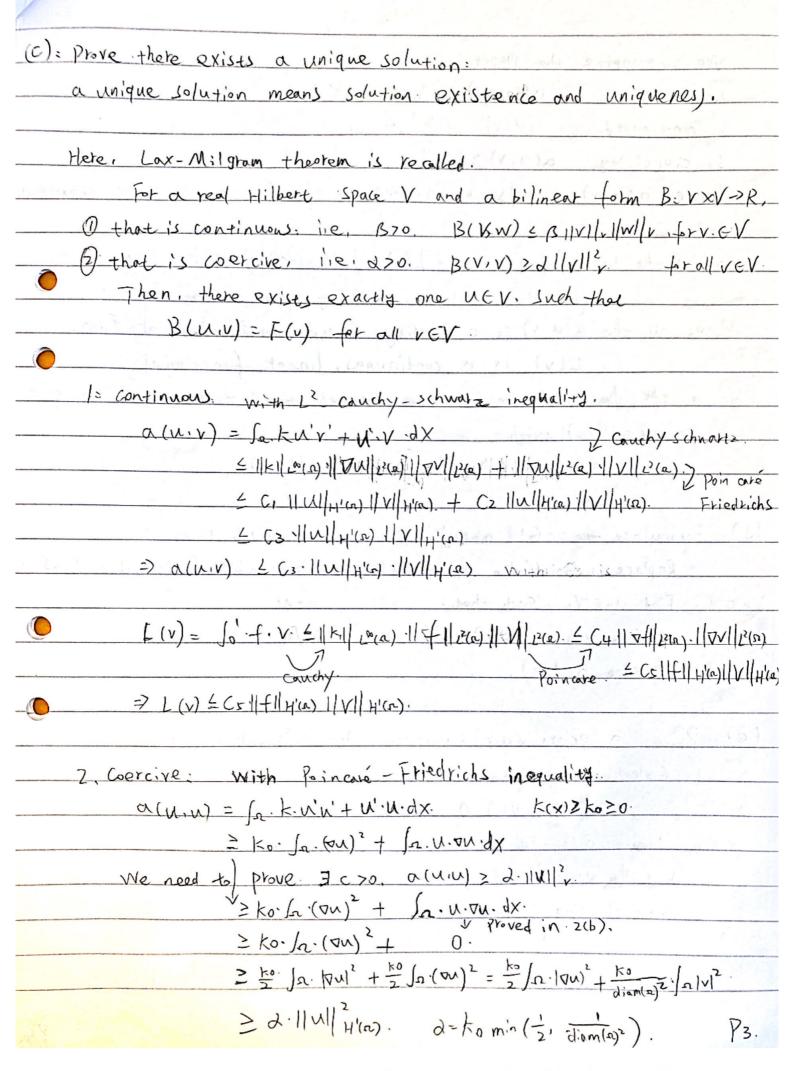
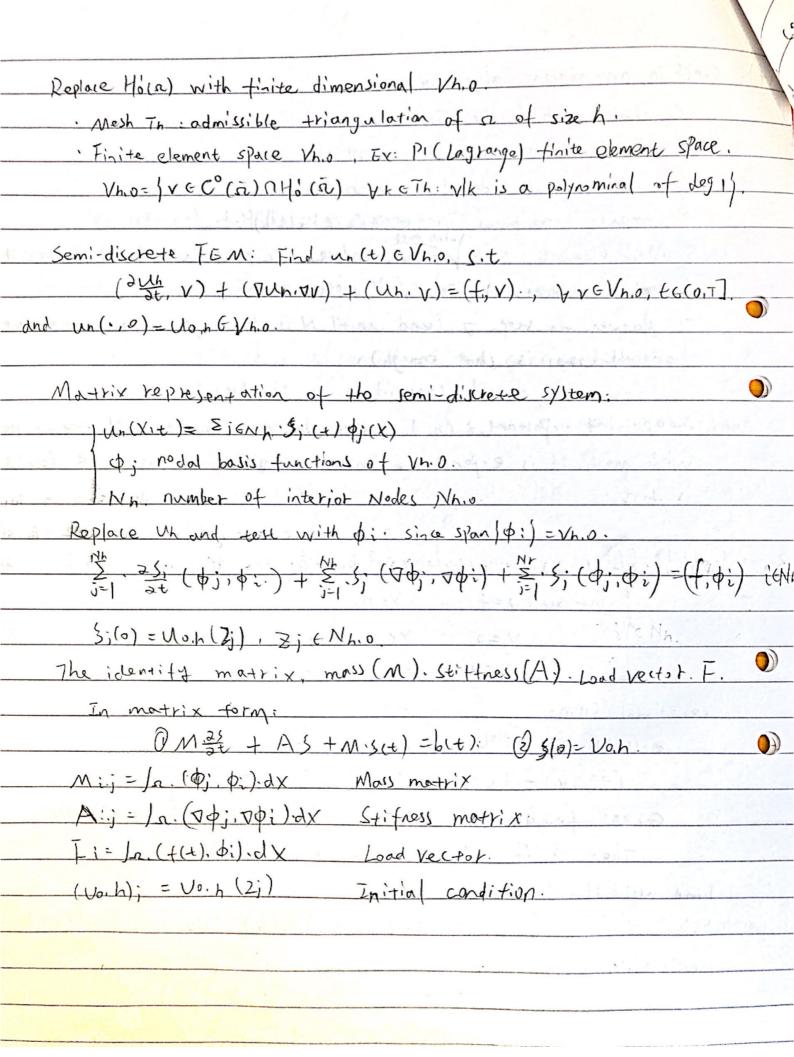
Pro	blem Set B.
- Landania all III de	Yanjun Zhang. PhD Student
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1.	xb. v. in de a la company
I(a) It only how Neumann !	pundary andition: n. Tu(x)=9, only this condition carnot
have a unique solution,	because u(x) is a solution, u(x)+c is still a
Solution for any const	ant c G/R.
APANAN	and fix bound of a x bow in les
● 1(b). I could not be abl	e to Solve this linear system. I have thied
for the project 1, w	hen I haven't add Pirishlet condition, the
coefficient matrix is	sing war. In other words, the determinant of
this matrix is zero,	So it does not have a unique inverse. I got
result is Inf or A	그 그 그는 사람들이 가는 것이 되었다. 그는 그는 그는 그는 그를 보는 것이 되었다. 그는 그를 보는 것이 없는 것이 없는 것이 없었다. 그는 것이 없는 것이 없어요? 그 없다면 없는 것이 없다면 다른 것이다.
	dinas de la companya
2.	the state of the s
The state of the s	al formulation:
(a).	$, \nu(0) = 0 \nu(1) = 0.$
= V=H'(s)	A CWANT CELLER
	Vigtela and a second
	$e^{-(k(x)u'(x))'+u(x)}=f(x).$
Jo + Y= Jo -	$(ku')'v + u' \cdot V$
= 50'-15	"", " + ", " , " , " , " , " , " , " , "
The variational f	prinulation is: find UEV. Such that
a(u,v)= L(V). YVEV
	- Soku'v' + U'.V -dX
L(v) =	(° · f ·)





(f): Stops in an adaptive algorithm:
1: Construct mesh, initial Th.
2. Solve finite element problem for uh.
3. Compute local indicators RK(UK)2.
4. Compute maximum m: maxxeTh Rk(Uh)2.
5. Mark element with r.m., where ocrcl is a tixed Parameter.
6. Refine elements to got new may Th.
7. Return to step 2 (end until N is too large, N is return times
or the error is small enough)
Comparis to the property of the party of the second of the
Why adaptivity important: could reduce the error cheaply, if refine the
whole much, it is expensive. Instead, only refine the mesh locally
is fost,
3. Show spatial discretization and identity the eneries:
$\int V - \Delta u + u = f$, $\chi \in \Omega$.
N=0 ,X620, t70
L u=u0, xen. t=0
rariational form:
multiply by Ve Ho (a) and integrate over a.
$\left(\frac{\partial u}{\partial t}, v\right) - \left(\lambda u, v\right) + \left(u, v\right) = (f, v)$
Green's formula: Sa. K. Du. DV = - Sa V. (k. Du). V + ER n. (K. Du). V
Then => (3t, v) + (vvi vv) + (v.v) = (f, v).
Tind ult) of fo(a), such that
(32. V) + (DV,DV) + (N,V) = (f,V), VVEHo(a) te(0.7).
and u(', 0)=U0
Se mi-discrete:
PS.



consider the convection - diffusion-reaction equation, write down a finite element method. u- Esu+β. Vu+d. u=f, (x, t) ∈ Ω × (0.7), 6>0. Multiply by VEHOLD and integrate over 1. $\left(\frac{\partial U}{\partial t}, V\right) - \left(\varepsilon \cdot \Delta U, V\right) + \left(\beta \cdot \nabla U, V\right) + \left(\partial U, V\right) = \left(f, V\right)$ Green's formula: for kion. DV = -la. D. (k. Du). V + /21 · n. (kou). V. and assume W=0 on 20. gives. (BY.V)+ (E. VU. DV) + (BDU.V) + (dU,V) = (f, V). YVEHO(R) + (10.7) w(1,0)=100 Replace. Ho (a) with finite dimensional Vh.o. Vh.o = [VEC°(a) A Ho(a), YEETh: V/L is a polynomial of deg 1) The admissible triangulation of 12 of Size h The matrix representation: Uh (x.t) = Ejenh Sj (t) ; (x). \$1. nodal basis functions of Vho Nr. number of interior rodes. Assume on (T). Tis bound any B=(B1, B2) representing convection velocity. T= = { (x.+) & T = B(x,+) · n(x) < 0} [+ = \ (x.t) &T: B(x.t) · n(x) >0 \. n(x) is the outward normal to Tat point X. Si (φ; φ;) + 5=1 · ε · ξ; (νφ; , νφ;) + 5=1 · β; (νφ; , φ;) + ξ ος (φ; φ;)

Σ ος (φ; φ;) + Σ ος (φ; φ;) Silo) = Un.h (Zi) = 3; 6 N4.0.

$M: j = Ja.(\phi; \phi; dx)$	
$Aij = \int a.(\nabla \phi_j, \nabla \phi_j) \cdot dx$	Jacker
$B_{ij} = (a \cdot (\nabla \phi_i, \phi_i) \cdot dX$	
$ \frac{d}{dx} = \int_{a} \left(f(t) \cdot \phi_{i} \right) \cdot dx $	
$(vo,h)_{j} = (vo,h(2j))$	
(v.+) - (v.+) - (v.+) - (v.+) - (v.+) - (v.+)	
In matrix form:	
1 M 2 + 6. A ; 5 + B. B; 5 + d. M 5 = F	
S(0) = Up.h.	
- 14 (x) A	
Implicit Euler time stepping: Let 0=tocticctn=T, with kn=toti-	tn:
at is approximated by a backnard quotient.	
M. (37+1-5") + c.A.j. 5n+1 + B.B.j. 5n+1 + d.M. 5n+1 = T (+n+1) = n	≥0
1 30 = Uo, h.	10 4 × 10 ×
Rearronging.	
) (M + kn/) + kn/B·B + kn·d·M.). 5n+ = M·5n+ kn·F(tn+1).	720
- 15° = Vo. h	
(b): assume e=1. d(x)= +(x)=0. B=[0.0], prove that	
11U(7) 2+2/07 117U 2.d+=11U6 3 Yt>0.	À
take above information in convection - diffusion-reaction aquation.	
y - 6. Sut B. Dutdu=f.	
1 i - BU = of	
W=U07	
A (V6H'(a) => Ja u'v + Ja. Vu Vv=0=> Ja d(") + fa (Vu) =0	
integrate in T: [o] for it (z) dx dt + fo fa (vu) dx dt = 0.	
=> 11 (V(T))11 + 2 /5 11 DV11 dt = U 2) Yt>0.	
U(7) decrease as time increases, since vull >0, while: u(t) nee	d to small
to fulfil the above equation,	P8.
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