

Oct 01, 08 15:50

m5176.txt

Page 1/2

* Appendix A

* Problems 5 and 6 are periodic problems on $[-1, 1]$. For problem 5 $a = 1$
 * and for problem 6 $a = -1$. The initial condition is $u(0, x) = \sin(2\pi x)$.
 * Therefore for problem 5 the exact solution $u(0.625, 0) = \sin(-1.25\pi) = 0.7071068$
 * and for problem 6 the exact solution $u(0.625, 0) = \sin(1.25\pi) = -0.7071068$.
 * For these computations here $T = 0.625$. In the computational results
 * M is the number of subintervals used in the x -direction and N is the number
 * of time steps used in the t -direction. $k = T/N$ and $h = 2/M$.

* I. Forward-time Backward-space (On page 17 scheme (1.3.2))

* a. $k/h = 1.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FB: M=	30 N=	5	x=0.000	V= 0.97655161
Problem 5 and FB: M=	60 N=	10	x=0.000	V= 0.93145078
Problem 5 and FB: M=	120 N=	20	x=0.000	V= 0.83044629
Problem 5 and FB: M=	240 N=	40	x=0.000	V=-1.56205136
Problem 5 and FB: M=	480 N=	80	x=0.000	V=-428218790272275136.00000000

* b. $k/h = 0.75$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FB: M=	30 N=	10	x=0.000	V= 0.67620129
Problem 5 and FB: M=	60 N=	20	x=0.000	V= 0.69028673
Problem 5 and FB: M=	120 N=	40	x=0.000	V= 0.69835704
Problem 5 and FB: M=	240 N=	80	x=0.000	V= 0.70264737

* c. $k/h = 0.75$ XXXXXXXXXXXXXXXXXXXX

Problem 6 and FB: M=	30 N=	10	x=0.000	V=-0.96722419
Problem 6 and FB: M=	60 N=	20	x=0.000	V=-1.26994659
Problem 6 and FB: M=	120 N=	40	x=0.000	V=82.89292456
Problem 6 and FB: M=	240 N=	80	x=0.000	V=-55434426102518161408.00000000

* II. Forward-time Forward-space (On page 17 scheme (1.3.1))

* a. $k/h = 1.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FF: M=	30 N=	5	x=0.000	V=-1.22233203
Problem 5 and FF: M=	60 N=	10	x=0.000	V= 1.23096268
Problem 5 and FF: M=	120 N=	20	x=0.000	V= 1.13581199
Problem 5 and FF: M=	240 N=	40	x=0.000	V=69268095751.51478577

* b. $k/h = 0.75$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FF: M=	30 N=	10	x=0.000	V= 0.96722419
Problem 5 and FF: M=	60 N=	20	x=0.000	V= 1.26994653
Problem 5 and FF: M=	120 N=	40	x=0.000	V=137.84517963
Problem 5 and FF: M=	240 N=	80	x=0.000	V=80904109735802208256.00000000

* c. $k/h = 0.75$ XXXXXXXXXXXXXXXXXXXX

Problem 6 and FF: M=	30 N=	10	x=0.000	V=-0.67620129
Problem 6 and FF: M=	60 N=	20	x=0.000	V=-0.69028673
Problem 6 and FF: M=	120 N=	40	x=0.000	V=-0.69835704
Problem 6 and FF: M=	240 N=	80	x=0.000	V=-0.70264737

* III. Forward-time Central-space (On page 17 scheme (1.3.3))

* a. $k/h = 1.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FC: M=	30 N=	5	x=0.000	V= 0.36438323
Problem 5 and FC: M=	60 N=	10	x=0.000	V= 1.10415477
Problem 5 and FC: M=	120 N=	20	x=0.000	V= 0.97125223
Problem 5 and FC: M=	240 N=	40	x=0.000	V= 0.84473237
Problem 5 and FC: M=	480 N=	80	x=0.000	V=-1119872321.32790852

* b. $k/h = 0.75$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FC: M=	30 N=	10	x=0.000	V= 0.94753686
Problem 5 and FC: M=	60 N=	20	x=0.000	V= 0.94473400
Problem 5 and FC: M=	120 N=	40	x=0.000	V= 0.83906403
Problem 5 and FC: M=	240 N=	80	x=0.000	V= 0.77463977
Problem 5 and FC: M=	480 N=	160	x=0.000	V=-392226.16637206
Problem 5 and FC: M=	960 N=	320	x=0.000	V=5160141857918015122517786624.00000000

* IV. Forward-time Central-space with a smoother (On page 55 scheme (2.2.13))

* a. $k/h = 1.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FCM: M=	30 N=	5	x=0.000	V= 0.29214760
Problem 5 and FCM: M=	60 N=	10	x=0.000	V= 0.98927477
Problem 5 and FCM: M=	120 N=	20	x=0.000	V= 0.91940800
Problem 5 and FCM: M=	240 N=	40	x=0.000	V= 0.82131202
Problem 5 and FCM: M=	480 N=	80	x=0.000	V= 0.76567147
Problem 5 and FCM: M=	960 N=	160	x=0.000	V=-23722260.37119842
Problem 5 and FCM: M=	1920 N=	320	x=0.000	V=-2893498669418610347704228547395584.00000000

* b. $k/h = 0.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FCM: M=	20 N=	10	x=0.000	V= 0.25540806
Problem 5 and FCM: M=	40 N=	20	x=0.000	V= 0.54851370
Problem 5 and FCM: M=	80 N=	40	x=0.000	V= 0.64879430
Problem 5 and FCM: M=	160 N=	80	x=0.000	V= 0.68308655

* V. Lax-Friedrichs (On page 17 scheme (1.3.5))

* a. $k/h = 1.5$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and LF: M=	30 N=	5	x=0.000	V= 0.78789146
----------------------	-------	---	---------	---------------

Oct 01, 08 15:50

m5176.txt

Page 2/2

Problem 5 and LF: M= 60 N= 10 x=0.000 V= 1.01522828
 Problem 5 and LF: M= 120 N= 20 x=0.000 V= 0.89390354
 Problem 5 and LF: M= 240 N= 40 x=0.000 V= 0.80388608
 Problem 5 and LF: M= 480 N= 80 x=0.000 V=102254.23274636
 Problem 5 and LF: M= 960 N= 160 x=0.000 V=1318201470613820112956817408.00000000

* b. k/h = 0.75 XXXXXXXXXXXXXXXXXXXX

Problem 5 and LF: M= 30 N= 10 x=0.000 V= 0.65619412
 Problem 5 and LF: M= 60 N= 20 x=0.000 V= 0.67557566
 Problem 5 and LF: M= 120 N= 40 x=0.000 V= 0.68982300
 Problem 5 and LF: M= 240 N= 80 x=0.000 V= 0.69808883

* c. k/h = 0.75 XXXXXXXXXXXXXXXXXXXX

Problem 6 and LF: M= 30 N= 10 x=0.000 V=-0.65619412
 Problem 6 and LF: M= 60 N= 20 x=0.000 V=-0.67557566
 Problem 6 and LF: M= 120 N= 40 x=0.000 V=-0.68982300
 Problem 6 and LF: M= 240 N= 80 x=0.000 V=-0.69808883

* VII. Lax-Wendroff (On page 62 scheme (3.1.1))

* a. k/h = 1.5 XXXXXXXXXXXXXXXXXXXX

Problem 5 and LW: M= 30 N= 5 x=0.000 V= 0.99592977
 Problem 5 and LW: M= 60 N= 10 x=0.000 V= 0.76997988
 Problem 5 and LW: M= 120 N= 20 x=0.000 V= 1.15249155
 Problem 5 and LW: M= 240 N= 40 x=0.000 V=833926366015841.87500000
 Problem 5 and LW: M= 480 N= 80 x=0.000 V=-5698518090509798084929856521943507115752554496.00000000

* b. k/h = 0.75 XXXXXXXXXXXXXXXXXXXX

Problem 5 and LW: M= 30 N= 10 x=0.000 V= 0.69497006
 Problem 5 and LW: M= 60 N= 20 x=0.000 V= 0.70431985
 Problem 5 and LW: M= 120 N= 40 x=0.000 V= 0.70644888
 Problem 5 and LW: M= 240 N= 80 x=0.000 V= 0.70694755

* c. k/h = 0.75 XXXXXXXXXXXXXXXXXXXX

Problem 6 and LW: M= 30 N= 10 x=0.000 V=-0.69497006
 Problem 6 and LW: M= 60 N= 20 x=0.000 V=-0.70431985
 Problem 6 and LW: M= 120 N= 40 x=0.000 V=-0.70644888
 Problem 6 and LW: M= 240 N= 80 x=0.000 V=-0.70694755

* IX. Crank-Nicolson scheme (On page 17 scheme (3.1.3))

* a. k/h = 2 XXXXXXXXXXXXXXXXXXXX

Problem 5 and CN: M= 80 N= 10 x=0.000 V= 0.65978717
 Problem 5 and CN: M= 160 N= 20 x=0.000 V= 0.69531388
 Problem 5 and CN: M= 320 N= 40 x=0.000 V= 0.70416163
 Problem 5 and CN: M= 640 N= 80 x=0.000 V= 0.70637066

* b. k/h = 0.5 XXXXXXXXXXXXXXXXXXXX

Problem 5 and CN: M= 20 N= 10 x=0.000 V= 0.47200721
 Problem 5 and CN: M= 40 N= 20 x=0.000 V= 0.65121125
 Problem 5 and CN: M= 80 N= 40 x=0.000 V= 0.69337186
 Problem 5 and CN: M= 160 N= 80 x=0.000 V= 0.70368896

* c. k/h = 0.5 XXXXXXXXXXXXXXXXXXXX

Problem 6 and CN: M= 20 N= 10 x=0.000 V=-0.47200720
 Problem 6 and CN: M= 40 N= 20 x=0.000 V=-0.65121125
 Problem 6 and CN: M= 80 N= 40 x=0.000 V=-0.69337186
 Problem 6 and CN: M= 160 N= 80 x=0.000 V=-0.70368896

* XII. Back-time Central-space (On page 35 scheme (1.6.1))

* a. k/h = 2 XXXXXXXXXXXXXXXXXXXX

Problem 5 and BC: M= 80 N= 10 x=0.000 V= 0.27161772
 Problem 5 and BC: M= 160 N= 20 x=0.000 V= 0.45829118
 Problem 5 and BC: M= 320 N= 40 x=0.000 V= 0.57577004
 Problem 5 and BC: M= 640 N= 80 x=0.000 V= 0.64002944
 Problem 5 and BC: M= 1280 N= 160 x=0.000 V= 0.67327525
 Problem 5 and BC: M= 2560 N= 320 x=0.000 V= 0.69012655
 Problem 5 and BC: M= 5120 N= 640 x=0.000 V= 0.69860172

* b. k/h = 0.5 XXXXXXXXXXXXXXXXXXXX

Problem 5 and BC: M= 20 N= 10 x=0.000 V= 0.19647697
 Problem 5 and BC: M= 40 N= 20 x=0.000 V= 0.43280412
 Problem 5 and BC: M= 80 N= 40 x=0.000 V= 0.56767836
 Problem 5 and BC: M= 160 N= 80 x=0.000 V= 0.63771061
 Problem 5 and BC: M= 320 N= 160 x=0.000 V= 0.67265283
 Problem 5 and BC: M= 640 N= 320 x=0.000 V= 0.68996524
 Problem 5 and BC: M= 1280 N= 640 x=0.000 V= 0.69856065
 Problem 5 and BC: M= 2560 N= 1280 x=0.000 V= 0.70284029

* c. k/h = 0.5 XXXXXXXXXXXXXXXXXXXX

Problem 6 and BC: M= 20 N= 10 x=0.000 V=-0.19647695
 Problem 6 and BC: M= 40 N= 20 x=0.000 V=-0.43280412
 Problem 6 and BC: M= 80 N= 40 x=0.000 V=-0.56767836
 Problem 6 and BC: M= 160 N= 80 x=0.000 V=-0.63771061
 Problem 6 and BC: M= 320 N= 160 x=0.000 V=-0.67265283
 Problem 6 and BC: M= 640 N= 320 x=0.000 V=-0.68996524
 Problem 6 and BC: M= 1280 N= 640 x=0.000 V=-0.69856065
 Problem 6 and BC: M= 2560 N= 1280 x=0.000 V=-0.70284029

Oct 01, 08 15:49

m5176-2.txt

Page 1/1

* Appendix B

* Problems 5 and 6 are periodic problems on $[-1, 1]$. For problem 5 $a = 1$
 * and for problem 6 $a = -1$. The initial condition is $u(0, x) = \sin(2\pi x)$.
 * Therefore for problem 5 the exact solution $u(0.625, 0) = \sin(-1.25\pi) = 0.7071068$
 * and for problem 6 the exact solution $u(0.625, 0) = \sin(1.25\pi) = -0.7071068$.
 * For these computations here $T = 0.625$. In the computational results
 * M is the number of subintervals used in the x -direction and N is the number
 * of time steps used in the t -direction. $k = T/N$ and $h = 2/M$.

* III. Forward-time Central-space (On page 17 scheme (1.3.3))

* c. $k/(h^2) = \text{constant}$ XXXXXXXXXXXXXXXXXXXX

Problem 5 and FC: M=	20	N=	10	x=0.000	V=	0.69679988
Problem 5 and FC: M=	40	N=	40	x=0.000	V=	0.78405304
Problem 5 and FC: M=	80	N=	160	x=0.000	V=	0.72906785
Problem 5 and FC: M=	160	N=	640	x=0.000	V=	0.71272996
Problem 5 and FC: M=	320	N=	2560	x=0.000	V=	0.70852029
Problem 5 and FC: M=	640	N=	10240	x=0.000	V=	0.70746060

* V. Lax-Friedrichs (On page 17 scheme (1.3.5))

* d. $k/(h^2) = \text{constant}$ XXXXXXXXXXXXXXXXXXXX

Problem 6 and LF: M=	50	N=	20	x=0.000	V=-	0.57163926
Problem 6 and LF: M=	100	N=	80	x=0.000	V=-	0.42091963
Problem 6 and LF: M=	200	N=	320	x=0.000	V=-	0.38692143
Problem 6 and LF: M=	400	N=	1280	x=0.000	V=-	0.37869433
Problem 6 and LF: M=	800	N=	5120	x=0.000	V=-	0.37665489
Problem 6 and LF: M=	1600	N=	20480	x=0.000	V=-	0.37614611
Problem 6 and LF: M=	3200	N=	81920	x=0.000	V=-	0.37601899