

Advanced Numerical Techniques

Assignment - 6

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Question 1

Solve using Crank Nicolson Method:-

$$du/dt = k * d^2u/dx^2$$

$$u(x,0) = \cos \pi x/2$$

$$u(-1,t) = 0, u(1,t) = 0, t = 1$$

$$dt = 1/27$$

$$dx = 1/3$$

Solution:

[0, 0.4999999999999999, 0.8660254037844386, 1.0, 0.8660254037844387,
0.5000000000000000, 0]

[0, 0.4572508991051355, 0.7919817890566452, 0.914501798210271, 0.7919817890566453,
0.4572508991051357, 0]

[0, 0.4181567694649096, 0.7242687702420896, 0.8363135389298193, 0.7242687702420898,
0.4181567694649098, 0]

[0, 0.3824051176094576, 0.6623450927739325, 0.7648102352189154, 0.6623450927739328,
0.3824051176094578, 0]

[0, 0.34971016769865915, 0.6057157783775101, 0.6994203353973186,
0.6057157783775104, 0.3497101676986593, 0]

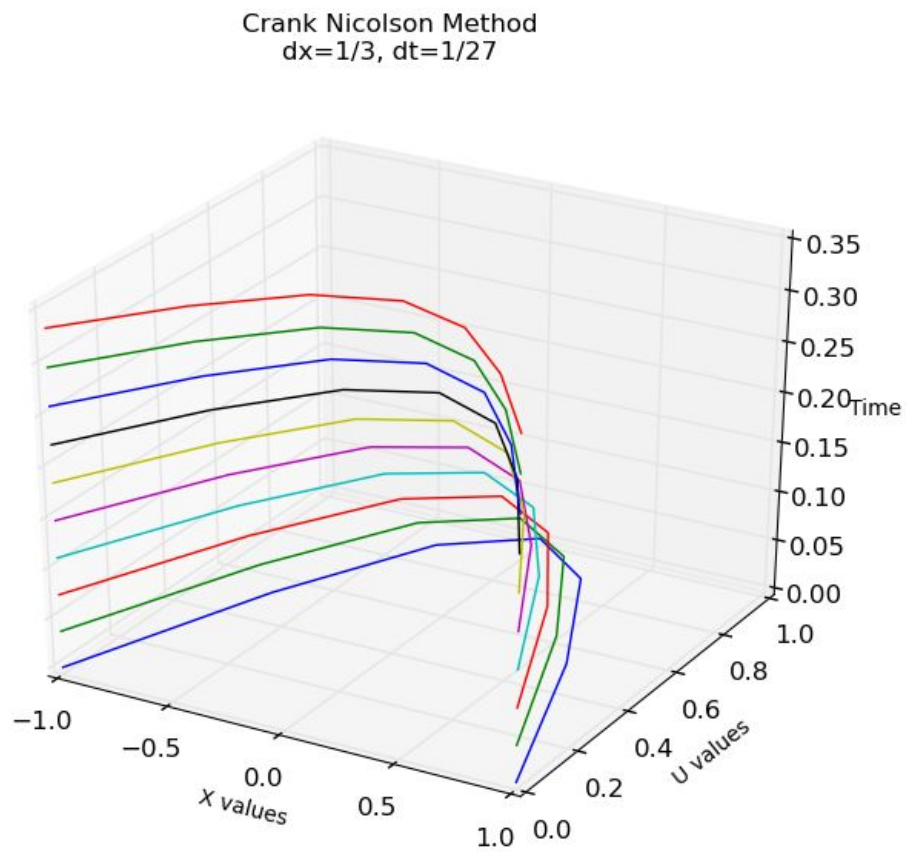
[0, 0.31981057721283923, 0.553928168530567, 0.6396211544256787, 0.5539281685305673,
0.31981057721283934, 0]

[0, 0.2924673479478062, 0.5065683062005256, 0.5849346958956126, 0.5065683062005258, 0.2924673479478063, 0]

[0, 0.2674619156160578, 0.4632576269367119, 0.5349238312321157, 0.4632576269367121, 0.2674619156160579, 0]

[0, 0.24459440278364866, 0.42364993286824587, 0.48918880556729744, 0.4236499328682461, 0.24459440278364877, 0]

[0, 0.22368202117781402, 0.3874286254196715, 0.44736404235562816, 0.3874286254196716, 0.22368202117781413, 0]



Question 2:

Solve using Crank Nicolson Method and Fictitious Method

$$du/dt = k * d^2u/dx^2$$

$$u(x,0) = 1, 0 < x < 1$$

$$u(0,t) = u'(0,t), u(1,t) = -u'(1,t), t = 1$$

$$dt = 0.04;$$

$$dx = 0.2;$$

$$r = 1$$

Solution:

[1, 1, 1, 1, 1, 1]

[0.7924528301886793, 0.9433962264150944, 0.9811320754716981,
0.9811320754716981, 0.9433962264150942, 0.7924528301886791]

[0.7490210039159844, 0.8629405482378071, 0.9291562833748664,
0.9291562833748664, 0.862940548237807, 0.7490210039159843]

[0.692034363938016, 0.809339253209025, 0.8671453616072328, 0.8671453616072327,
0.8093392532090248, 0.6920343639380159]

[0.6478433950984737, 0.7543230887952204, 0.8102692345371593,
0.8102692345371593, 0.7543230887952204, 0.6478433950984737]

[0.6043032414985876, 0.7047127215213673, 0.7564350149512489, 0.756435014951249,
0.7047127215213673, 0.6043032414985877]

[0.5644214769462393, 0.6578751760600767, 0.706340970844231, 0.706340970844231,
0.6578751760600767, 0.5644214769462392]

[0.5269529800780584, 0.6143056755008994, 0.659507274135069, 0.659507274135069,
0.6143056755008994, 0.5269529800780582]

[0.4920405465383733, 0.5735741228991336, 0.6157956908450339,
0.6157956908450339, 0.5735741228991336, 0.4920405465383737]

[0.4594200318585112, 0.5355580564972657, 0.5749759567471444,
0.5749759567471444, 0.5355580564972657, 0.4594200318585116]

[0.4289687042661592, 0.5000570992599868, 0.5368637041681322,
0.5368637041681323, 0.5000570992599868, 0.4289687042661592]

