



North South University

Department of Electrical and Computer Engineering

Course Title: CSE417

Section: 02

Faculty: Dr. Shahnewaz Siddique

Name: B. M. Raihanul Haque

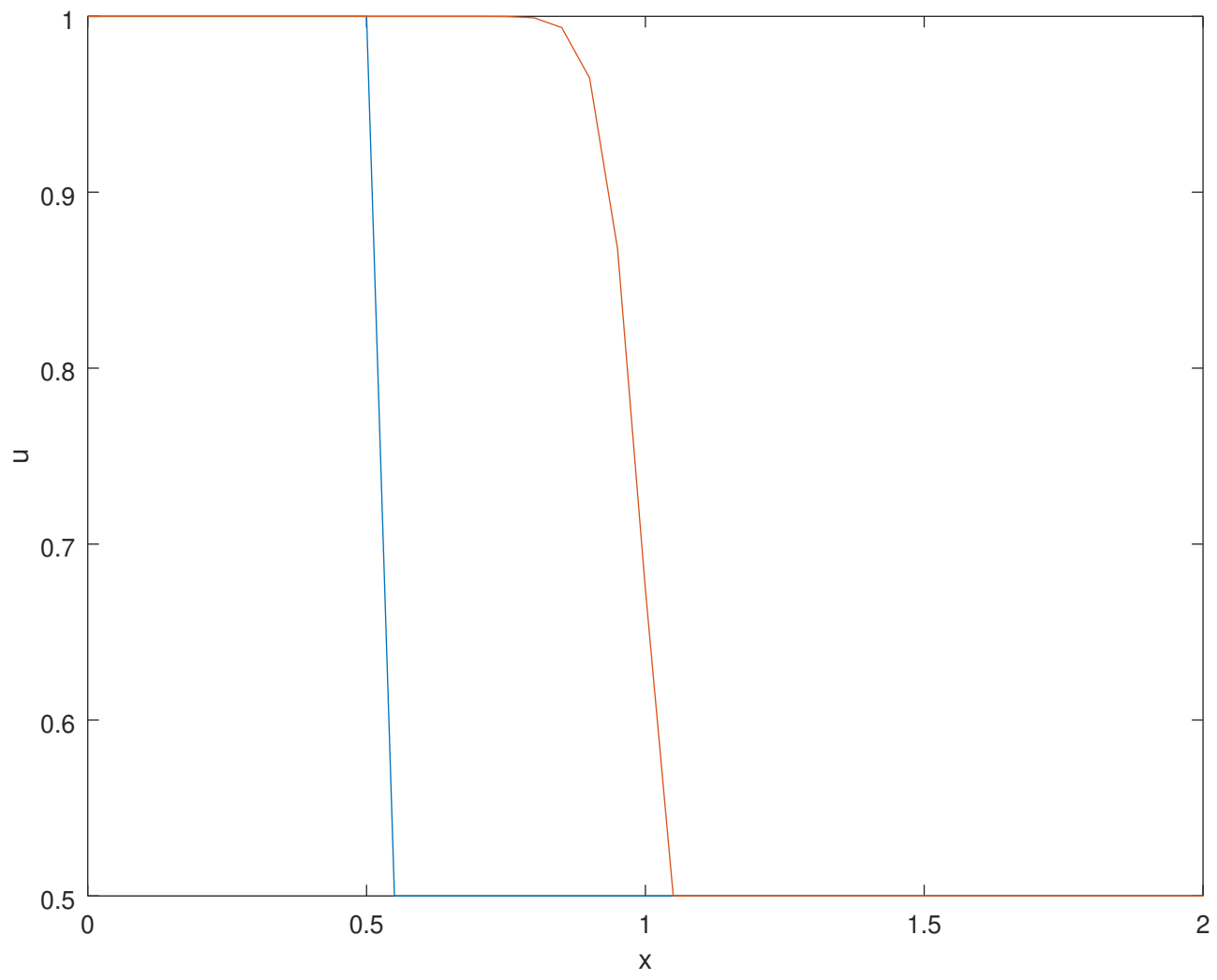
ID: 1512756042

```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - ((c*delT/delX)*(u_i_n(i) - u_i_n(i-1)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) - u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (1) - Explicit Backward part (a)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```

Method (1) - Explicit Backward part (a)

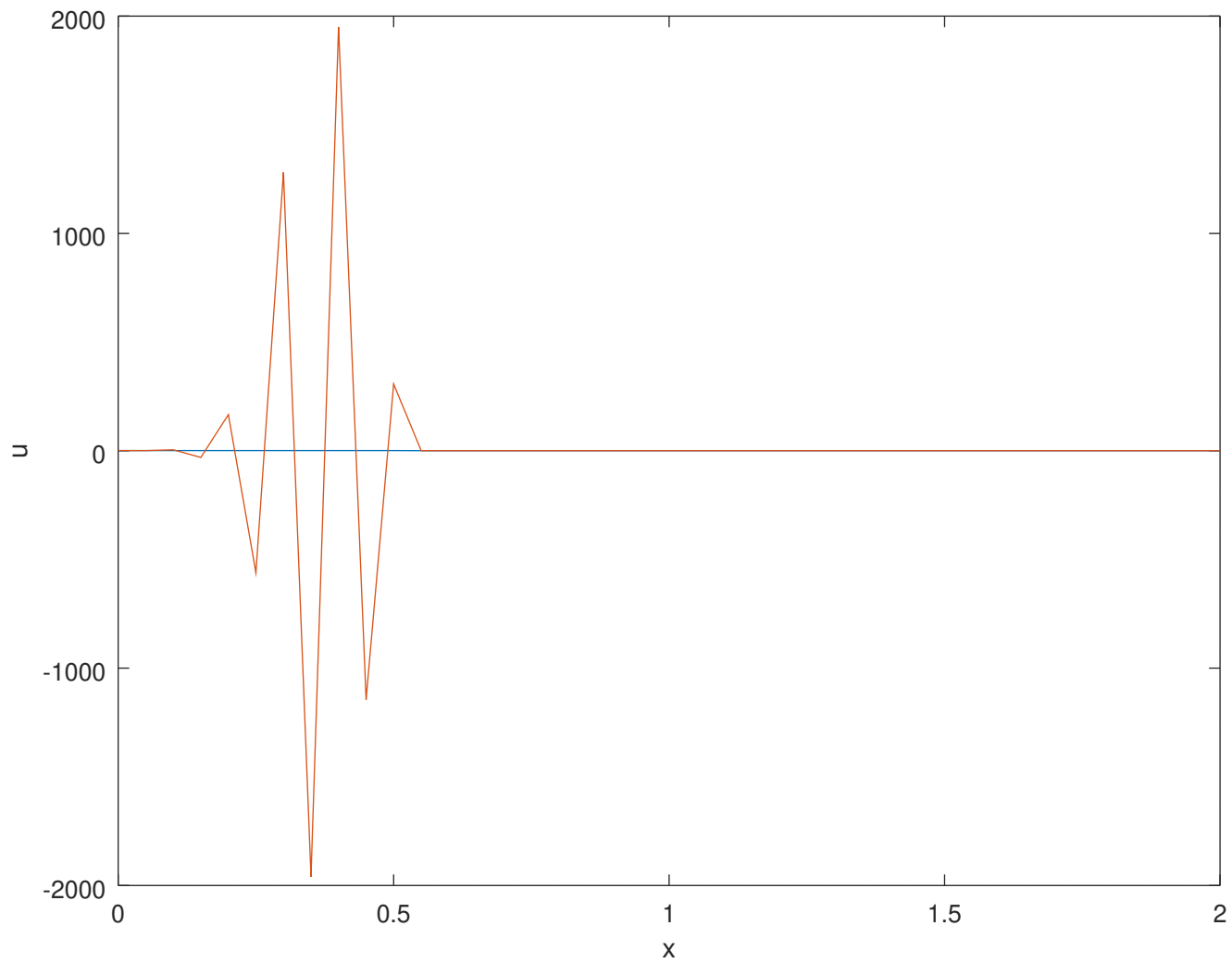


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - ((c*delT/delX)*(u_i_n(i+1) - u_i_n(i)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) -
u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (2) - Explicit Forward part (a)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```

Method (2) - Explicit Forward part (a)

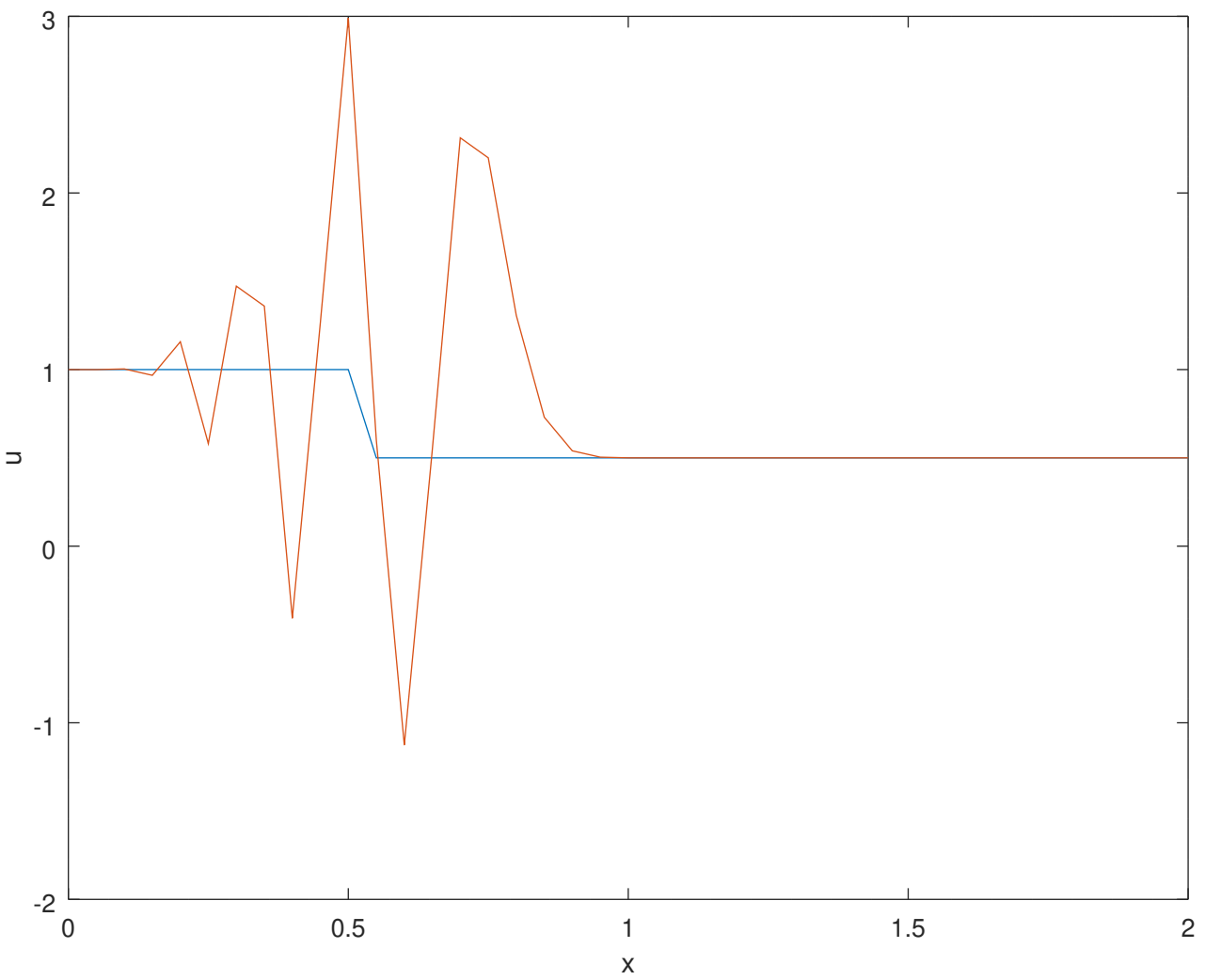


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - ((c*delT/(delX*2))*(u_i_n(i+1) - u_i_n(i-1)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) - u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (3) - Explicit Central part (a)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```

Method (3) - Explicit Central part (a)

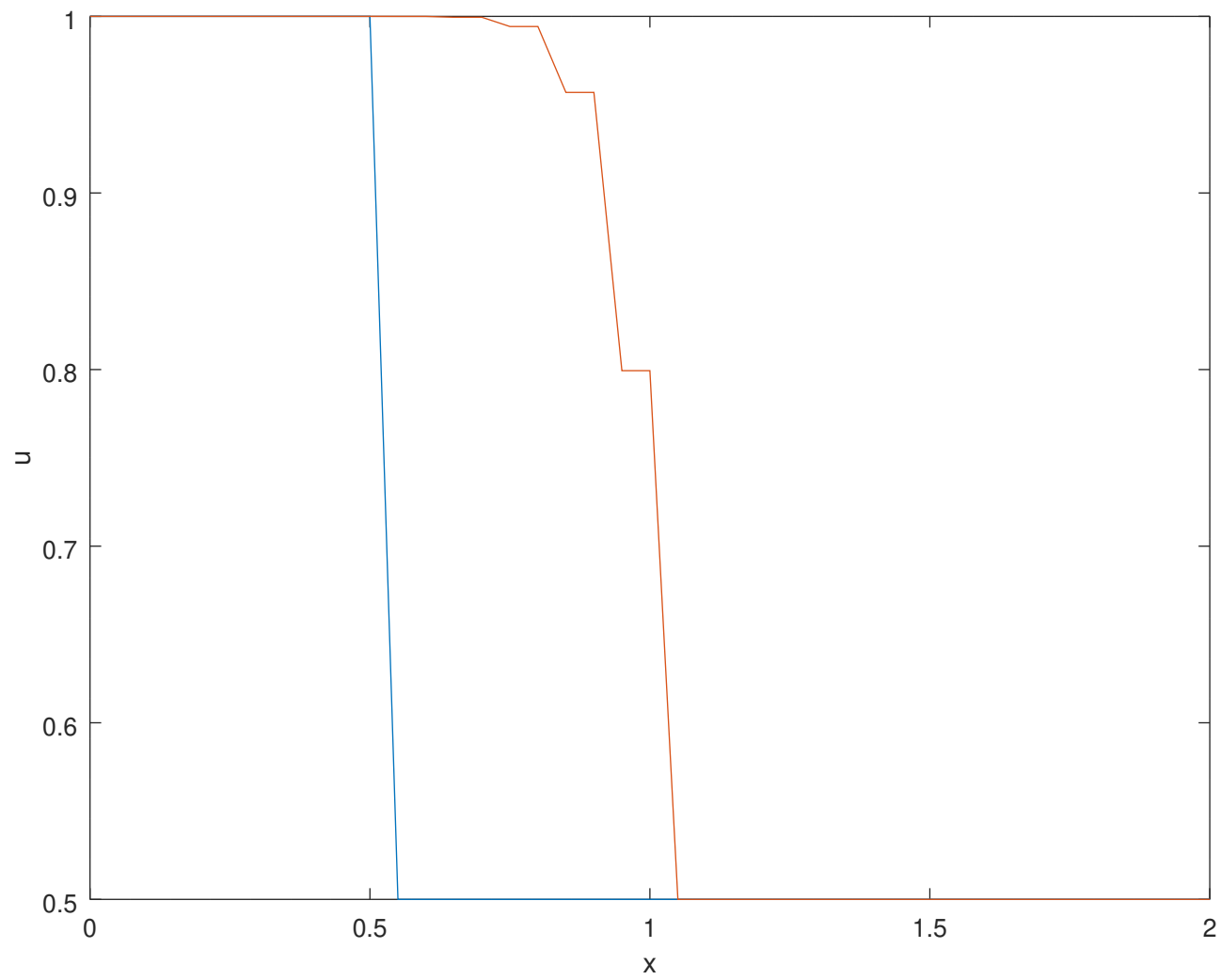


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = ((u_i_n(i+1) + u_i_n(i-1))/2) - ((c*delT/(delX*2))*(u_i_n(i+1)
- u_i_n(i-1)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) - u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (4) - Lax part (a)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```


Method (4) - Lax part (a)

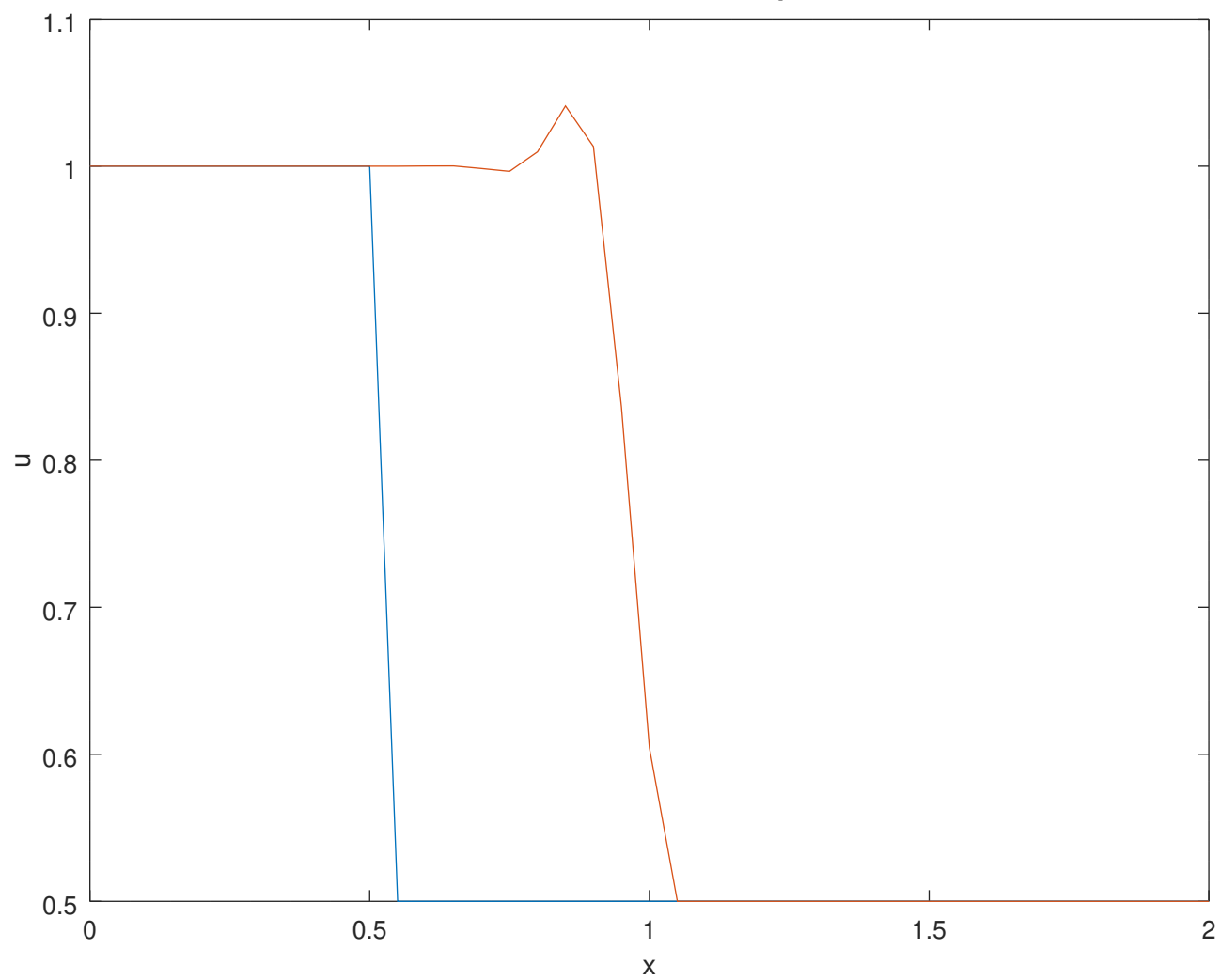


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - ((c*delT/(delX*2))*(u_i_n(i+1) - u_i_n(i-1))) + (0.5
* c * c * (delT/delX) * (delT/delX) * (u_i_n(i+1) - (2 * u_i_n(i)) + u_i_n(i-1)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) - u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (5) - Lax-Wendroff part (a)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```

Method (5) - Lax-Wendroff part (a)

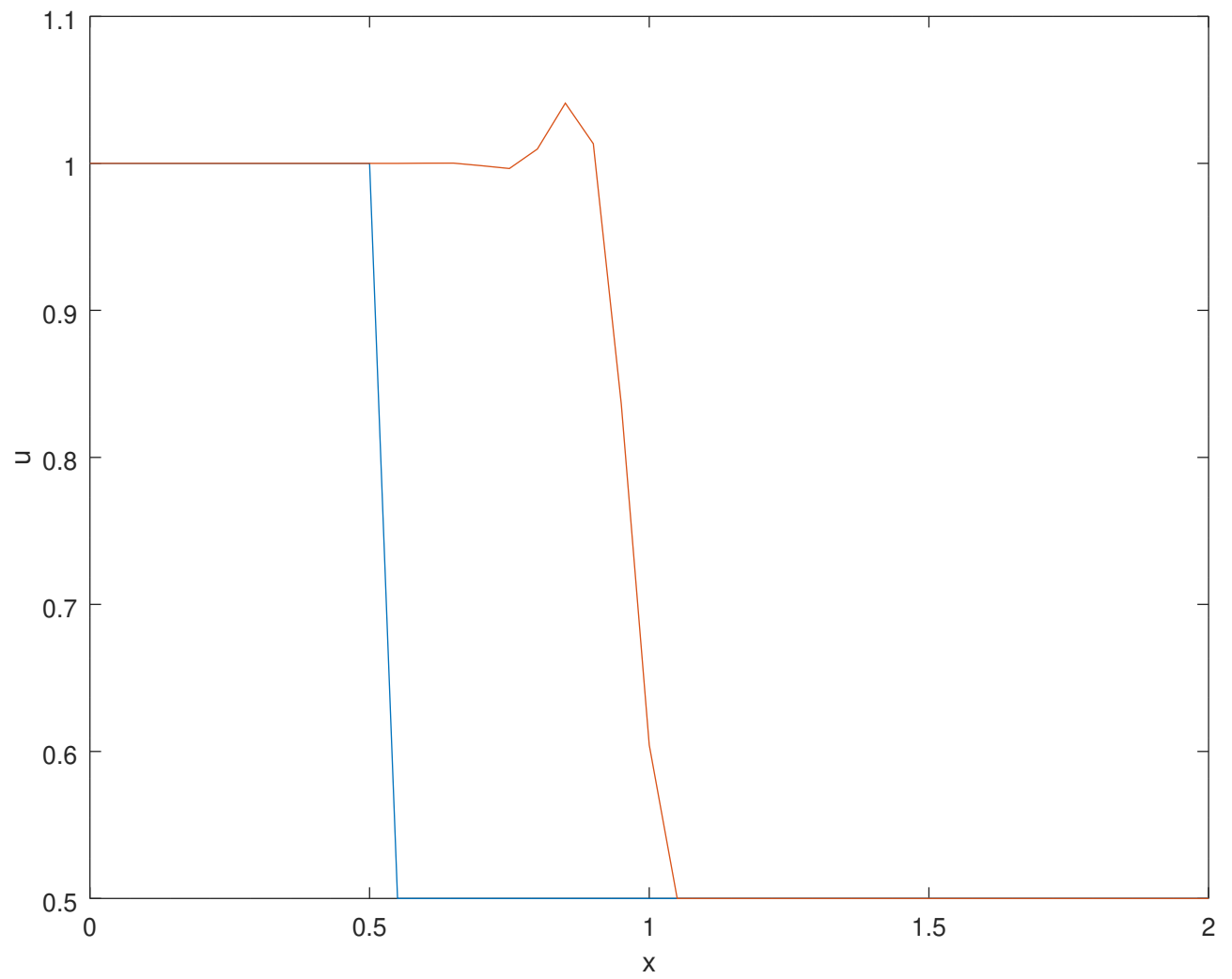


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  ubar_i_n_plus_1 = zeros(1, N);
8  u_i_n_plus_1 = zeros(1, N);
9
10 for i = 1: N
11     x_i(i) = (i-1) * delX;
12 end
13
14 for i = 1: N
15     if x_i(i) <= 0.5
16         u_i_n(i) = 1;
17     else
18         u_i_n(i) = 0.5;
19     end
20 end
21
22 plot(x_i, u_i_n);
23
24 while n < 10
25     delT = 0.9 * delX / c;
26
27     for i = 1: N-1
28         ubar_i_n_plus_1(i) = u_i_n(i) - ((c*delT/delX)*(u_i_n(i+1) - u_i_n(i)));
29     end
30
31     for i = 2: N-1
32         u_i_n_plus_1(i) = 0.5*(u_i_n(i) + ubar_i_n_plus_1(i) -
33         ((c*delT/delX)*(ubar_i_n_plus_1(i) - ubar_i_n_plus_1(i-1))));
34     end
35
36     u_i_n_plus_1(N) = u_i_n(N) - ((c*delT/delX)*(u_i_n(N) - u_i_n(N-1)));
37
38     for i = 2: N
39         u_i_n(i) = u_i_n_plus_1(i);
40     end
41
42     n = n+1;
43 end
44
45 hold on;
46
47 plot(x_i, u_i_n);
48 title('Method (6) - MacCormack part (a)');
49 xlabel('x'); ylabel('u');
50
51 hold off;

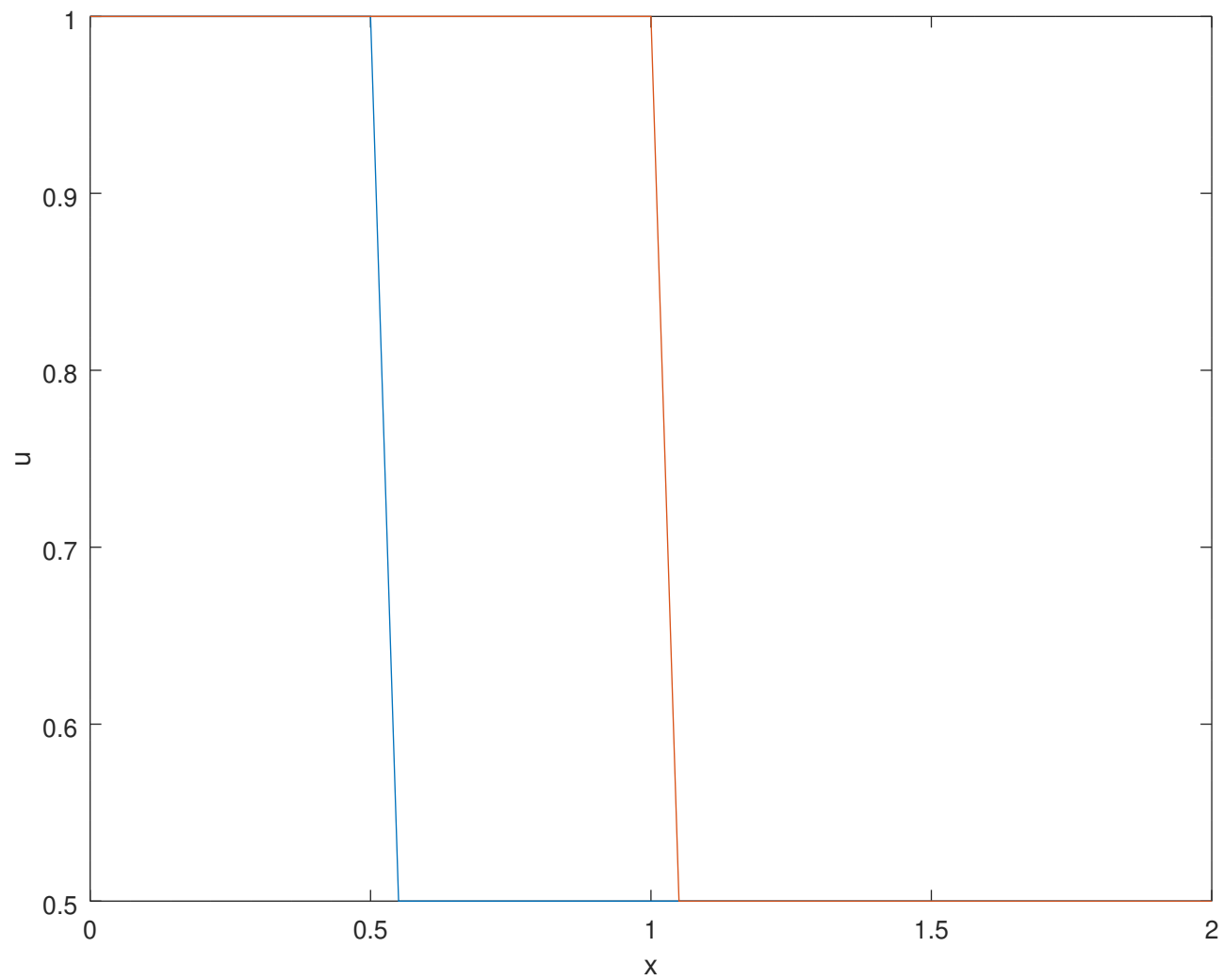
```

Method (6) - MacCormack part (a)



```
1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - (u_i_n(i) - u_i_n(i-1));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - (u_i_n(N) - u_i_n(N-1));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (1) - Explicit Backward part (b)');
44 xlabel('x'); ylabel('u');
45
46 hold off;
```

Method (1) - Explicit Backward part (b)

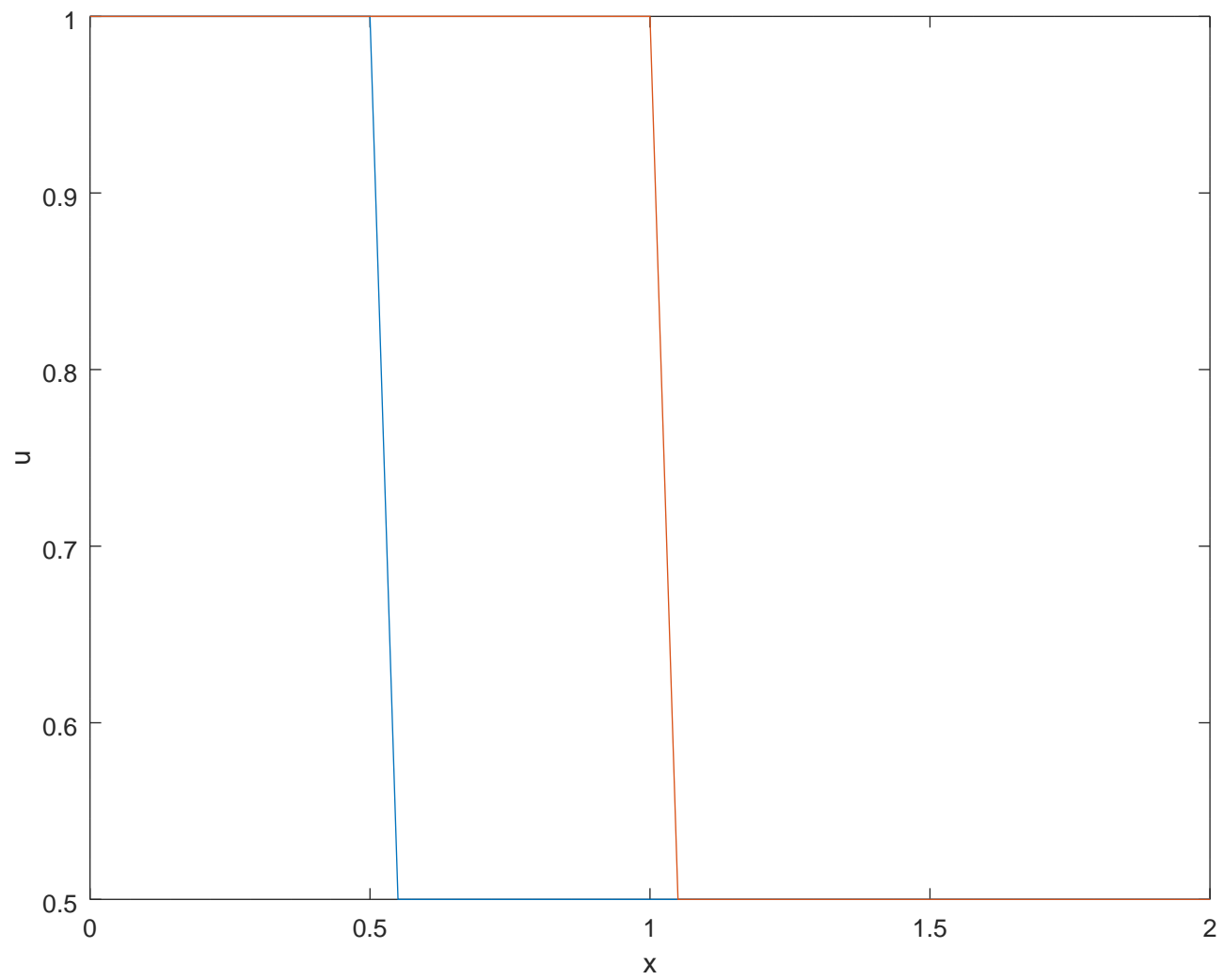


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = ((u_i_n(i+1) + u_i_n(i-1))/2) - (0.5*(u_i_n(i+1) - u_i_n(i-1)));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - (u_i_n(N) - u_i_n(N-1));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (4) - Lax part (b)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```


Method (4) - Lax part (b)

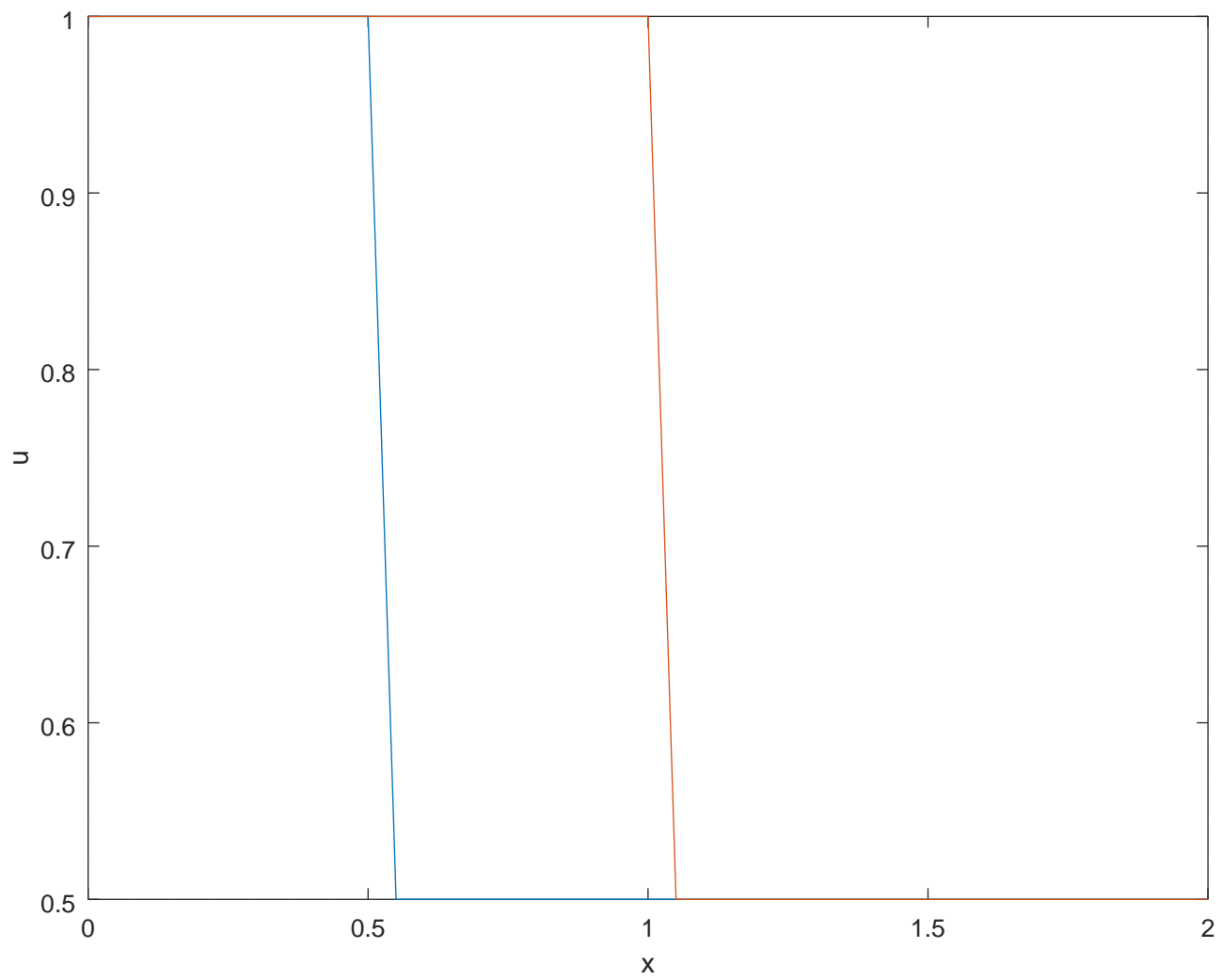


```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  u_i_n_plus_1 = zeros(1, N);
8
9  for i = 1: N
10     x_i(i) = (i-1) * delX;
11 end
12
13 for i = 1: N
14     if x_i(i) <= 0.5
15         u_i_n(i) = 1;
16     else
17         u_i_n(i) = 0.5;
18     end
19 end
20
21 plot(x_i, u_i_n);
22
23 while n < 10
24     delT = 0.9 * delX / c;
25
26     for i = 2: N-1
27         u_i_n_plus_1(i) = u_i_n(i) - ((0.5)*(u_i_n(i+1) - u_i_n(i-1))) + (0.5 *
(u_i_n(i+1) - (2 * u_i_n(i)) + u_i_n(i-1)))));
28     end
29
30     u_i_n_plus_1(N) = u_i_n(N) - ((u_i_n(N) - u_i_n(N-1)));
31
32     for i = 2: N
33         u_i_n(i) = u_i_n_plus_1(i);
34     end
35
36     n = n+1;
37
38 end
39
40 hold on;
41
42 plot(x_i, u_i_n);
43 title('Method (5) - Lax-Wendroff part (b)');
44 xlabel('x'); ylabel('u');
45
46 hold off;

```

Method (5) - Lax-Wendroff part (b)



```

1  n = 0;
2  N = 41;
3  c = 1;
4  delX = 2/40;
5  x_i = zeros(1, N);
6  u_i_n = zeros(1, N);
7  ubar_i_n_plus_1 = zeros(1, N);
8  u_i_n_plus_1 = zeros(1, N);
9
10 for i = 1: N
11     x_i(i) = (i-1) * delX;
12 end
13
14 for i = 1: N
15     if x_i(i) <= 0.5
16         u_i_n(i) = 1;
17     else
18         u_i_n(i) = 0.5;
19     end
20 end
21
22 plot(x_i, u_i_n);
23
24 while n < 10
25     delT = 0.9 * delX / c;
26
27     for i = 1: N-1
28         ubar_i_n_plus_1(i) = u_i_n(i) - (u_i_n(i+1) - u_i_n(i));
29     end
30
31     for i = 2: N-1
32         u_i_n_plus_1(i) = 0.5*(u_i_n(i) + ubar_i_n_plus_1(i) - (ubar_i_n_plus_1(i) -
ubar_i_n_plus_1(i-1)));
33     end
34
35     u_i_n_plus_1(N) = u_i_n(N) - (u_i_n(N) - u_i_n(N-1));
36
37     for i = 2: N
38         u_i_n(i) = u_i_n_plus_1(i);
39     end
40
41     n = n+1;
42
43 end
44
45 hold on;
46
47 plot(x_i, u_i_n);
48 title('Method (6) - MacCormack part (b)');
49 xlabel('x'); ylabel('u');
50
51 hold off;

```

Method (6) - MacCormack part (b)

