

1. The following row interchanges are required for these systems.
  - (a) none
  - (b) Interchange rows 2 and 3.
  - (c) none
  - (d) Interchange rows 1 and 2.
  
2. The following row interchanges are required for these systems.
  - (a) none
  - (b) none
  - (c) none
  - (d) none
  
3. The following row interchanges are required for these systems.
  - (a) Interchange rows 1 and 2.
  - (b) Interchange rows 1 and 3.
  - (c) Interchange rows 1 and 2, then interchange rows 2 and 3.
  - (d) Interchange rows 1 and 2.
  
4. The following row interchanges are required for these systems.
  - (a) Interchange rows 2 and 3.
  - (b) Interchange rows 1 and 3.
  - (c) Interchange rows 1 and 3, then interchange rows 2 and 3.
  - (d) Interchange rows 1 and 2.
  
5. The following row interchanges are required for these systems.
  - (a) Interchange rows 1 and 3, then interchange rows 2 and 3.
  - (b) Interchange rows 2 and 3.
  - (c) Interchange rows 2 and 3.
  - (d) Interchange rows 1 and 3, then interchange rows 2 and 3.
  
6. The following row interchanges are required for these systems.
  - (a) Interchange rows 2 and 3.
  - (b) none
  - (c) Interchange rows 1 and 2, then interchange rows 2 and 3.
  - (d) none

7. The following row interchanges are required for these systems.
- (a) Interchange rows 1 and 2, and columns 1 and 3, then interchange rows 2 and 3, and columns 2 and 3.
  - (b) Interchange rows 1 and 2, and columns 1 and 3, then interchange rows 2 and 3.
  - (c) Interchange rows 1 and 2, and columns 1 and 3, then interchange rows 2 and 3.
  - (d) Interchange rows 1 and 2, and columns 1 and 2, then interchange rows 2 and 3; and columns 2 and 3.
8. The following row interchanges are required for these systems.
- (a) Interchange rows 1 and 2, and columns 1 and 3.
  - (b) Interchange rows 1 and 2, and columns 1 and 2, then interchange rows 2 and 3.
  - (c) Interchange rows 1 and 3, and columns 1 and 2, then interchange rows 2 and 3, and columns 2 and 3.
  - (d) Interchange rows 1 and 2.
9. Gaussian elimination with three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 30.0, x_2 = 0.990$
  - (b)  $x_1 = 0.00, x_2 = 10.0, x_3 = 0.142$
  - (c)  $x_1 = 0.206, x_2 = 0.0154, x_3 = -0.0156, x_4 = -0.716$
  - (d)  $x_1 = 0.828, x_2 = -3.32, x_3 = 0.153, x_4 = 4.91$
10. Gaussian elimination with three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 1.00, x_2 = 9.98$
  - (b)  $x_1 = 12.0, x_2 = 0.492, x_3 = -9.78$
  - (c)  $x_1 = -8.25, x_2 = -8.00, x_3 = -0.0339, x_4 = 0.0566$
  - (d)  $x_1 = 1.33, x_2 = -4.66, x_3 = -4.04, x_4 = -1.66$
11. Gaussian elimination with three-digit rounding arithmetic gives the following results.
- (a)  $x_1 = -10.0, x_2 = 1.01$
  - (b)  $x_1 = 0.00, x_2 = 10.0, x_3 = 0.143$
  - (c)  $x_1 = 0.185, x_2 = 0.0103, x_3 = -0.0200, x_4 = -1.12$
  - (d)  $x_1 = 0.799, x_2 = -3.12, x_3 = 0.151, x_4 = 4.56$

12. Gaussian elimination with three-digit rounding arithmetic gives the following results.
- (a)  $x_1 = 1.00, x_2 = 10.0$
  - (b)  $x_1 = 12.0, x_2 = 0.499, x_3 = -1.98$
  - (c)  $x_1 = 0.0896, x_2 = -0.0639, x_3 = -0.0361, x_4 = 0.0467$
  - (d)  $x_1 = 1.35, x_2 = -4.73, x_3 = -4.07, x_4 = -1.65$
13. Gaussian elimination with partial pivoting and three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = -0.163, x_2 = 9.98, x_3 = 0.142$
  - (c)  $x_1 = 0.177, x_2 = -0.0072, x_3 = -0.0208, x_4 = -1.18$
  - (d)  $x_1 = 0.777, x_2 = -3.10, x_3 = 0.161, x_4 = 4.50$
14. Gaussian elimination with partial pivoting gives the following results.
- (a)  $x_1 = 1.00, x_2 = 9.98$
  - (b)  $x_1 = 12.0, x_2 = 0.504, x_3 = -9.78$
  - (c)  $x_1 = 0.0928, x_2 = -0.0631, x_3 = -0.0356, x_4 = 0.0468$
  - (d)  $x_1 = 1.33, x_2 = -4.66, x_3 = -4.04, x_4 = -1.66$
15. Gaussian elimination with partial pivoting and three-digit rounding arithmetic gives the following results.
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = 0.00, x_2 = 10.0, x_3 = 0.143$
  - (c)  $x_1 = 0.178, x_2 = 0.0127, x_3 = -0.0204, x_4 = -1.16$
  - (d)  $x_1 = 0.845, x_2 = -3.37, x_3 = 0.182, x_4 = 5.07$
16. Gaussian elimination with partial pivoting and three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 1.00, x_2 = 10.0$
  - (b)  $x_1 = 12.0, x_2 = 0.499, x_3 = -1.98$
  - (c)  $x_1 = 0.0927, x_2 = -0.0631, x_3 = -0.0362, x_4 = 0.0465$
  - (d)  $x_1 = 1.35, x_2 = -4.73, x_3 = -4.07, x_4 = -1.65$

17. Gaussian elimination with scaled partial pivoting and three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = -0.163, x_2 = 9.98, x_3 = 0.142$
  - (c)  $x_1 = 0.171, x_2 = 0.0102, x_3 = -0.0217, x_4 = -1.27$
  - (d)  $x_1 = 0.687, x_2 = -2.66, x_3 = 0.117, x_4 = 3.59$
18. Gaussian elimination with scaled partial pivoting gives the following results.
- (a)  $x_1 = 1.00, x_2 = 9.98$
  - (b)  $x_1 = 0.993, x_2 = 0.500, x_3 = -1.00$
  - (c)  $x_1 = 0.0930, x_2 = -0.0631, x_3 = -0.0359, x_4 = 0.0467$
  - (d)  $x_1 = 1.33, x_2 = -4.66, x_3 = -4.04, x_4 = -1.66$
19. Gaussian elimination with scaled partial pivoting and three-digit rounding arithmetic gives the following results.
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = 0.00, x_2 = 10.0, x_3 = 0.143$
  - (c)  $x_1 = 0.180, x_2 = 0.0128, x_3 = -0.0200, x_4 = -1.13$
  - (d)  $x_1 = 0.783, x_2 = -3.12, x_3 = 0.147, x_4 = 4.53$
20. Gaussian elimination with scaled partial pivoting and three-digit chopping arithmetic gives the following results.
- (a)  $x_1 = 1.00, x_2 = 10.0$
  - (b)  $x_1 = 1.03, x_2 = 0.502, x_3 = -1.01$
  - (c)  $x_1 = 0.0927, x_2 = -0.0630, x_3 = -0.0360, x_4 = 0.0467$
  - (d)  $x_1 = 1.35, x_2 = -4.73, x_3 = -4.07, x_4 = -1.65$
21. Using Algorithm 6.1 in Maple with *Digits*:=10 gives
- (a)  $x_1 = 10.00000000, x_2 = 1.000000000$
  - (b)  $x_1 = 0.000000033, x_2 = 10.00000001, x_3 = 0.1428571429$
  - (c)  $x_1 = 0.1768252958, x_2 = 0.0126926913, x_3 = -0.0206540503, x_4 = -1.182608714$
  - (d)  $x_1 = 0.7883937842, x_2 = -3.125413672, x_3 = 0.1675965951, x_4 = 4.557002521$

22. Using Algorithm 6.1 in Maple with  $Digits:=10$  gives

- (a)  $x_1 = 1.000000000, x_2 = 10.000000000$
- (b)  $x_1 = 1.000000300, x_2 = 0.500000001, x_3 = -1.000000306$
- (c)  $x_1 = 0.0927610467, x_2 = -0.06299433926, x_3 = -0.03624582267, x_4 = 0.04670801939$
- (d)  $x_1 = 1.349448559, x_2 = -4.677987755, x_3 = -4.032893779, x_4 = -1.656637732$

23. Using Algorithm 6.2 in Maple with  $Digits:=10$  gives

- (a)  $x_1 = 10.00000000, x_2 = 1.000000000$
- (b)  $x_1 = 0.000000000, x_2 = 10.00000000, x_3 = 0.142857142$
- (c)  $x_1 = 0.1768252975, x_2 = 0.0126926909, x_3 = -0.0206540502, x_4 = -1.182608696$
- (d)  $x_1 = 0.7883937863, x_2 = -3.125413680, x_3 = 0.1675965980, x_4 = 4.557002510$

24. Using Algorithm 6.2 in Maple with  $Digits:=10$  gives

- (a)  $x_1 = 1.000000000, x_2 = 10.000000000$
- (b)  $x_1 = 1.000000300, x_2 = 0.500000001, x_3 = -1.000000306$
- (c)  $x_1 = 0.09276104704, x_2 = -0.06299433961, x_3 = -0.03624582264, x_4 = 0.04670801938$
- (d)  $x_1 = 1.349448559, x_2 = -4.677987755, x_3 = -4.032893779, x_4 = -1.656637732$

25. Using Algorithm 6.3 in Maple with  $Digits:=10$  gives

- (a)  $x_1 = 10.00000000, x_2 = 1.000000000$
- (b)  $x_1 = 0.000000000, x_2 = 10.00000000, x_3 = 0.1428571429$
- (c)  $x_1 = 0.1768252977, x_2 = 0.0126926909, x_3 = -0.0206540501, x_4 = -1.182608693$
- (d)  $x_1 = 0.7883937842, x_2 = -3.125413672, x_3 = 0.1675965952, x_4 = 4.055700252$

26. Using Algorithm 6.3 in Maple with  $Digits:=10$  gives

- (a)  $x_1 = 1.000000000, x_2 = 10.000000000$
- (b)  $x_1 = 1.000000000, x_2 = 0.500000000, x_3 = -1.000000000$
- (c)  $x_1 = 0.09276104705, x_2 = -0.06299433961, x_3 = -0.03624582264, x_4 = 0.04670801938$
- (d)  $x_1 = 1.349448559, x_2 = -4.677987755, x_3 = -4.032893779, x_4 = -1.656637732$

27. Using Gaussian elimination with complete pivoting gives:

- (a)  $x_1 = 9.98, x_2 = 1.00$
- (b)  $x_1 = 0.0724, x_2 = 10.0, x_3 = 0.0952$
- (c)  $x_1 = 0.161, x_2 = 0.0125, x_3 = -0.0232, x_4 = -1.42$
- (d)  $x_1 = 0.719, x_2 = -2.86, x_3 = 0.146, x_4 = 4.00$

28. Gaussian elimination with complete pivoting gives the following results.
- (a)  $x_1 = 1.00, x_2 = 9.98$
  - (b)  $x_1 = 0.982, x_2 = 0.500, x_3 = -0.994$
  - (c)  $x_1 = 0.0933, x_2 = -0.0631, x_3 = -0.0360, 0.0464$
  - (d)  $x_1 = 1.33, x_2 = -4.66, x_3 = -4.04, x_4 = -1.65$
29. Using Gaussian elimination with complete pivoting and three-digit rounding arithmetic gives:
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = 0.00, x_2 = 10.0, x_3 = 0.143$
  - (c)  $x_1 = 0.179, x_2 = 0.0127, x_3 = -0.0203, x_4 = -1.15$
  - (d)  $x_1 = 0.874, x_2 = -3.49, x_3 = 0.192, x_4 = 5.33$
30. Gaussian elimination with complete pivoting and three-digit rounding gives the following results.
- (a)  $x_1 = 10.0, x_2 = 1.00$
  - (b)  $x_1 = 10.0, x_2 = 1.00$
  - (c)  $x_1 = 0.0926, x_2 = -0.0629, x_3 = -0.0361, x_4 = 0.0466$
  - (d)  $x_1 = 1.33, x_2 = -4.68, x_3 = -4.06, x_4 = -1.65$
31. The only system which does not require row interchanges is (a), where  $\alpha = 6$ .

32. Change Algorithm 6.2 as follows:

Add to STEP 1.

$$NCOL(i) = i$$

Replace STEP 3 with the following.

Let  $p$  and  $q$  be the smallest integers with  $i \leq p$ ,  $q \leq n$  and

$$|a(NROW(p), NCOL(q))| = \max_{i \leq k, j \leq n} |a(NROW(k), NCOL(j))|.$$

Add to STEP 4.

$$A(NROW(p), NCOL(q)) = 0$$

Add to STEP 5.

If  $NCOL(q) \neq NCOL(i)$  then set

$$\begin{aligned} NCOPY &= NCOL(i); \\ NCOL(i) &= NCOL(q); \\ NCOL(q) &= NCOPY. \end{aligned}$$

Replace STEP 7 with the following.

Set

$$m(NROW(j), NCOL(i)) = \frac{a(NROW(j), NCOL(i))}{a(NROW(i), NCOL(i))}.$$

Replace in STEP 8:

$$m(NROW(j), i) \text{ by } m(NROW(j), NCOL(i))$$

Replace in STEP 9:

$$a(NROW(n), n) \text{ by } a(NROW(n), NCOL(n))$$

Replace STEP 10 with the following.

Set

$$X(NCOL(n)) = \frac{a(NROW(n), n+1)}{a(NROW(n), NCOL(n))}.$$

Replace STEP 11 with the following.

Set

$$X(NCOL(i)) = \frac{a(NROW(i), n+1) - \sum_{j=i+1}^n a(NROW(i), NCOL(j)) \cdot X(NCOL(j))}{A(NROW(i), NCOL(i))}.$$

Replace STEP 12 with the following.

$$\text{OUTPUT } ('X(', NCOL(i), ') =', X(NCOL(i)) \text{ for } i = 1, \dots, n).$$

33. Using the Complete Pivoting Algorithm in Maple with Digits:=10 gives

- (a)  $x_1 = 10.00000000, x_2 = 1.000000000$
- (b)  $x_1 = 0.000000000, x_2 = 10.00000000, x_3 = 0.1428571429$
- (c)  $x_1 = 0.1768252974, x_2 = 0.01269269087, x_3 = -0.02065405015, x_4 = -1.182608697$
- (d)  $x_1 = 0.17883937840, x_2 = -3.125413669, x_3 = 0.1675965971, x_4 = 4.557002516$

34. Using the Complete Pivoting Algorithm in Maple with Digits:=10 gives

- (a)  $x_1 = 1.000000000, x_2 = 10.000000000$
- (b)  $x_1 = 1.000000001, x_2 = 0.5000000000, x_3 = -1.000000001$
- (c)  $x_1 = 0.09276104701, x_2 = -0.06299433960, x_3 = -0.03624582267, x_4 = 0.04670801937$
- (d)  $x_1 = 1.349448557, x_2 = -4.677987750, x_3 = -4.032893778, x_4 = -1.656637732$