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Practical 7
SOR Method

AIM :- To solve the following system of linear equations by using SOR Method within an absolute tolerance of 5*10^(-6):

4 x1 - x2 = 2

- x1 + 4 x2 - x3 = 4

- x2 + 4 x3 =10

In[1]:=
```
sor[A0_, B0_, X0_, max_, w_] :=
 Module[{A = N[A0], B = N[B0], i, j, k = 0, n = Length[X0], X = X0, Xold = X0},
  Print["X", 0, "=", X];
  While[k < max,
   For[i = 1, i <= n, i = i + 1,
    X[[i]] = (1 - w) * Xold[[i]] +
      w * (B[[i]] - Sum[A[[i, j]] * X[[j]], {j, 1, i - 1}] -
        Sum[A[[i, j]] * Xold[[j]], {j, i + 1, n}])/A[[i, i]]];
   Print["X", k + 1, "=", NumberForm[X, 10]];
   If[Max[Abs[X - Xold]] < 5 * 10^(-6),
    Print["Solution with convergence tolerance of 5x10^(-6)=",
     NumberForm[X, 10]];
    Break[];,
    Xold = X;
    k = k + 1;];];]
```

In[2]:=
```
A0 = {{4, 2, -1}, {2, 4, 1}, {-1, 1, 4}};
```

$$B0 = \begin{pmatrix} 1 \\ \end{pmatrix}$$

X0 =

```
-1  ;       0
 1          0  ;
            0
      sor  A0, B0, X0, 30, 0.9
```

```
X0=  0 ,  0 ,  0

X1=  0.225 ,  −0.32625 ,  0.34903125

X2=  0.4728445313 ,  −0.5489370703 ,  0.4898039854

X3=  0.6295120315 ,  −0.6733800179 ,  0.5671311096

X4=  0.7185767109 ,  −0.7433020214 ,  0.6106358257

X5=  0.7687366415 ,  −0.7826547516 ,  0.635126646

X6=  0.7969717977 ,  −0.8048062795 ,  0.648912732

X7=  0.8128653702 ,  −0.8172754092 ,  0.6566729486

X8=  0.8218118846 ,  −0.8242943024 ,  0.6610411869

X9=  0.8268478916 ,  −0.8282452485 ,  0.6635000752

X10=  0.8296826679 ,  −0.8304692423 ,  0.6648841873

X11=  0.831278368 ,  −0.831721132 ,  0.6656633062

X12=  0.8321765901 ,  −0.8324258226 ,  0.6661018735

X13=  0.8326822007 ,  −0.8328224941 ,  0.6663487437

X14=  0.8329668098 ,  −0.8330457811 ,  0.6664877073

X15=  0.8331270166 ,  −0.8331714697 ,  0.6665659302

X16=  0.8332171973 ,  −0.8332422201 ,  0.6666099619

X17=  0.8332679602 ,  −0.8332820455 ,  0.6666347475

X18=  0.8332965347 ,  −0.8333044633 ,  0.6666486993

X19=  0.8333126193 ,  −0.8333170824 ,  0.6666565528

X20=  0.8333216734 ,  −0.8333241856 ,  0.6666609736

X21=  0.8333267699 ,  −0.8333281841 ,  0.666663462

X22=  0.8333296388 ,  −0.8333304348 ,  0.6666648628

Solution with convergence tolerance of 5x10^(−6)=
   0.8333296388 ,  −0.8333304348 ,  0.6666648628
```

In[6]:=
```
Clear A0, B0, X0
```

In[7]:=
```
A0 = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};

B0 = {{10}, {-14}, {-33}};

X0 = {{0}, {0}, {0}};

sor A0, B0, X0, 30, 0.9
```

```
X0=  0 ,  0 ,  0

X1=  1.8 ,  −0.86 ,  4.253142857

X2=  0.6036685714 ,  −3.006156571 ,  3.972774269

X3=  0.971276303 ,  −2.998342474 ,  3.994010601

X4=  0.9989854592 ,  −2.99774285 ,  3.999851029

X5=  0.9995458885 ,  −2.99985093 ,  3.999965049

X6=  0.9999403385 ,  −2.999989011 ,  3.99999166

X7=  0.9999950583 ,  −2.999997048 ,  3.99999929

X8=  0.9999992301 ,  −2.999999652 ,  3.99999992

Solution with convergence tolerance of 5x10^(−6)=
   0.9999992301 ,  −2.999999652 ,  3.99999992
```