# Computer Lab 2 – Circuits
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# Example code for solving the example problem.

\[ A := \langle (-1, -1, 0) | (1, 0, -1) | (0, 1, 1) \rangle; \]

\[
\begin{bmatrix}
-1 & 1 & 0 \\
-1 & 0 & 1 \\
0 & -1 & 1
\end{bmatrix}
\]  \hspace{1cm} (1)

```maple
with(LinearAlgebra);
[&x, Add, Adjoint, BackwardSubstitute, BandMatrix, Basis, BezoutMatrix, BidiagonalForm,
BilinearForm, CharacteristicMatrix, CharacteristicPolynomial, Column, ColumnDimension,
ColumnOperation, ColumnSpace, CompanionMatrix, ConditionNumber, ConstantMatrix,
ConstantVector, Copy, CreatePermutation, CrossProduct, DeleteColumn, DeleteRow,
Determinant, Diagonal, DiagonalMatrix, Dimension, Dimensions, DotProduct,
EigenConditionNumbers, Eigenvalues, Eigenvectors, Equal, ForwardSubstitute,
FrobeniusForm, GaussianElimination, GenerateEquations, GenerateMatrix, Generic,
GetResultDataType, GetResultShape, GivensRotationMatrix, GramSchmidt, HankelMatrix,
HermiteForm, HermitianTranspose, HessenbergForm, HilbertMatrix, HouseholderMatrix,
IdentityMatrix, IntersectionBasis, IsDefinite, IsOrthogonal, IsSimilar, IsUnitary,
JordanBlockMatrix, JordanForm, KroneckerProduct, LA_Main, LUDEcomposition,
LeastSquares, LinearSolve, Map, Map2, MatrixAdd, MatrixExponential, MatrixFunction,
MatrixInverse, MatrixMatrixMultiply, MatrixNorm, MatrixPower, MatrixScalarMultiply,
MatrixVectorMultiply, MinimalPolynomial, Minor, Modular, Multiply, NoUserValue, Norm,
Normalize, NullSpace, OuterProductMatrix, Permanent, Pivot, PopovForm,
QRDecomposition, RandomMatrix, RandomVector, Rank, RationalCanonicalForm,
ReducedRowEchelonForm, Row, RowDimension, RowOperation, RowSpace, ScalarMatrix,
ScalarMultiply, ScalarVector, SchurForm, SingularValues, SmithForm,
StronglyConnectedBlocks, SubMatrix, SubVector, SumBasis, SylvesterMatrix,
ToeplitzMatrix, Trace, Transpose, TridiagonalForm, UnitVector, VandermondeMatrix,
VectorAdd, VectorAngle, VectorMatrixMultiply, VectorNorm, VectorScalarMultiply,
ZeroMatrix, ZeroVector, Zip]
```

\[ T := \text{Transpose}(A); \]

\[
\begin{bmatrix}
-1 & -1 & 0 \\
1 & 0 & -1 \\
0 & 1 & 1
\end{bmatrix}
\]  \hspace{1cm} (2)

\[ C := \langle \langle 1, 0, 0 \rangle | \langle 0, 1, 0 \rangle | \langle 0, 0, \frac{1}{2} \rangle \rangle; \]
\[
\begin{bmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & \frac{1}{2}
\end{bmatrix}
\] (4)

\[
B := T.C.A;
\]
\[
\begin{bmatrix}
2 & -1 & -1 \\
-1 & \frac{3}{2} & -\frac{1}{2} \\
-1 & -\frac{1}{2} & \frac{3}{2}
\end{bmatrix}
\] (5)

\[
c := (4, 0, -4);
\]
\[
\begin{bmatrix}
4 \\
0 \\
-4
\end{bmatrix}
\] (6)

# Note that the matrix B is singular, so we can't invert it.

\[B^{-1}\]

Error. (in rtable/Power) singular matrix

# So, we can't solve this by finding an inverse. This is not surprising, as the nullspace of A was one-dimensional.
# We need to use Maple's "solve" command.

\[eqn1 := 2v1 - v2 - v3 = 4;\]  \[2v1 - v2 - v3 = 4\] (7)

\[eqn2 := -v1 + \left(\frac{3}{2}\right)v2 - \left(\frac{1}{2}\right)v3 = 0;\]
\[-v1 + \frac{3}{2}v2 - \frac{1}{2}v3 = 0\] (8)

\[eqn3 := -v1 - \left(\frac{1}{2}\right)v2 + \left(\frac{3}{2}\right)v3 = -4;\]
\[-v1 - \frac{1}{2}v2 + \frac{3}{2}v3 = -4\] (9)

\[eqn4 := v3 = 0;\]
\[v3 = 0\] (10)

\[solve(\{eqn1, eqn2, eqn3, eqn4\}, \{v1, v2, v3\});\]
\[\{v1 = 3, v2 = 2, v3 = 0\}\] (11)

# So, our solutions is v1 = 3, v2 = 2, and v3 = 0.