```
> restart;
> unprotect('D');
> NPAF := proc(a,s)
    local i,j,n,npaf;
      npaf := 0;
      n := nops(a);
      for i from 1 to n-s do
         npaf := npaf + a[i]*a[i+s];
      od;
   RETURN(npaf);
   end proc;
```

$$NPAF := \mathbf{proc}(a, s) \tag{1}$$

    **local** $i, j, n, npaf;$

    $npaf := 0;$

    $n := nops(a);$

    **for** $i$ **to** $n - s$ **do** $npaf := npaf + a[i] * a[i + s]$ **end do**;

    $RETURN(npaf)$

**end proc**

```
> n := 3;
```

$$n := 3 \tag{2}$$

```
> A := Matrix(1,n,[seq(a||i,i=1..n)]);
  B := Matrix(1,n,[seq(b||i,i=1..n)]);
  C := Matrix(1,n-1,[seq(c||i,i=1..(n-1))]);
  D := Matrix(1,n-1,[seq(d||i,i=1..(n-1))]);
  rA := Matrix(1,n,ListTools[Reverse]([seq(a||i,i=1..n)]));
  rB := Matrix(1,n,ListTools[Reverse]([seq(b||i,i=1..n)]));
  rC := Matrix(1,n-1,ListTools[Reverse]([seq(c||i,i=1..(n-1))]));
  rD := Matrix(1,n-1,ListTools[Reverse]([seq(d||i,i=1..(n-1))]));
```

$$A := \begin{bmatrix} a1 & a2 & a3 \end{bmatrix}$$

$$B := \begin{bmatrix} b1 & b2 & b3 \end{bmatrix}$$

$$C := \begin{bmatrix} c1 & c2 \end{bmatrix}$$

$$D := \begin{bmatrix} d1 & d2 \end{bmatrix}$$

$$rA := \begin{bmatrix} a3 & a2 & a1 \end{bmatrix}$$

$$rB := \begin{bmatrix} b3 & b2 & b1 \end{bmatrix}$$

$$rC := \begin{bmatrix} c2 & c1 \end{bmatrix}$$

$$rD := \begin{bmatrix} d2 & d1 \end{bmatrix} \tag{3}$$

```
>
```

**A,B,C,D below are BS(3,2)**

```
> n := 3;
  A := Matrix(1,n,[1, 1, 1]);
  B := Matrix(1,n,[1, 1,-1]);
  C := Matrix(1,n-1,[1,-1]);
```

```
D := Matrix(1,n-1,[1,-1]);

seq(
NPAF(convert(A,list),s)+NPAF(convert(B,list),s)+
NPAF(convert(C,list),s)+NPAF(convert(D,list),s),s=1..2);

rA := Matrix(1,n,ListTools[Reverse]([1, 1, 1]));
rB := Matrix(1,n,ListTools[Reverse]([1, 1,-1]));
rC := Matrix(1,n-1,ListTools[Reverse]([1,-1]));
rD := Matrix(1,n-1,ListTools[Reverse]([1,-1]));
```

$$n := 3$$

$$A := \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$$

$$B := \begin{bmatrix} 1 & 1 & -1 \end{bmatrix}$$

$$C := \begin{bmatrix} 1 & -1 \end{bmatrix}$$

$$D := \begin{bmatrix} 1 & -1 \end{bmatrix}$$

$$0, 0$$

$$rA := \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$$

$$rB := \begin{bmatrix} -1 & 1 & 1 \end{bmatrix}$$

$$rC := \begin{bmatrix} -1 & 1 \end{bmatrix}$$

$$rD := \begin{bmatrix} -1 & 1 \end{bmatrix}$$

(4)

```
> x := Matrix(4,1,[1,1,1,1]);
  y := Matrix(4,1,[1,1,-1,-1]);
  z := Matrix(4,1,[-1,1,-1,1]);
  w := Matrix(4,1,[-1,1,1,-1]);
```

$$x := \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$y := \begin{bmatrix} 1 \\ 1 \\ -1 \\ -1 \end{bmatrix}$$

$$z := \begin{bmatrix} -1 \\ 1 \\ -1 \\ 1 \end{bmatrix}$$

$$w := \begin{bmatrix} -1 \\ 1 \\ 1 \\ -1 \end{bmatrix}$$

(5)

```
>
```

construct the different blocks in the list of 44 blocks

```
> xA  := x.A;
  mxA := -x.A;

  xC  := x.C;
  mxC := -x.C;

  xD  := x.D;

  mxrB := -x.rB;
```

$$xA := \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

$$mxA := \begin{bmatrix} -1 & -1 & -1 \\ -1 & -1 & -1 \\ -1 & -1 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

$$xC := \begin{bmatrix} 1 & -1 \\ 1 & -1 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$$

$$mxC := \begin{bmatrix} -1 & 1 \\ -1 & 1 \\ -1 & 1 \\ -1 & 1 \end{bmatrix}$$

$$xD := \begin{bmatrix} 1 & -1 \\ 1 & -1 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$$

(6)

$$mxrB := \begin{bmatrix} 1 & -1 & -1 \\ 1 & -1 & -1 \\ 1 & -1 & -1 \\ 1 & -1 & -1 \end{bmatrix} \tag{6}$$

```
> yA := y.A;

  yB := y.B;
  myB := -y.B;

  yD := y.D;
  myD := -y.D;

  yrC := y.rC;
```

$$yA := \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ -1 & -1 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

$$yB := \begin{bmatrix} 1 & 1 & -1 \\ 1 & 1 & -1 \\ -1 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}$$

$$myB := \begin{bmatrix} -1 & -1 & 1 \\ -1 & -1 & 1 \\ 1 & 1 & -1 \\ 1 & 1 & -1 \end{bmatrix}$$

$$yD := \begin{bmatrix} 1 & -1 \\ 1 & -1 \\ -1 & 1 \\ -1 & 1 \end{bmatrix}$$

$$myD := \begin{bmatrix} -1 & 1 \\ -1 & 1 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$$

$$\tag{7}$$

$$yrC := \begin{bmatrix} -1 & 1 \\ -1 & 1 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$$

(7)

```
> zA  := z.A;
  mzA := -z.A;

  mzB := -z.B;

  zC  := z.C;
  mzC := -z.C;
  zD  := z.D;

  zrD := z.rD;
```

$$zA := \begin{bmatrix} -1 & -1 & -1 \\ 1 & 1 & 1 \\ -1 & -1 & -1 \\ 1 & 1 & 1 \end{bmatrix}$$

$$mzA := \begin{bmatrix} 1 & 1 & 1 \\ -1 & -1 & -1 \\ 1 & 1 & 1 \\ -1 & -1 & -1 \end{bmatrix}$$

$$mzB := \begin{bmatrix} 1 & 1 & -1 \\ -1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

$$zC := \begin{bmatrix} -1 & 1 \\ 1 & -1 \\ -1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$mzC := \begin{bmatrix} 1 & -1 \\ -1 & 1 \\ 1 & -1 \\ -1 & 1 \end{bmatrix}$$

$$zD := \begin{bmatrix} -1 & 1 \\ 1 & -1 \\ -1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$zrD := \begin{bmatrix} 1 & -1 \\ -1 & 1 \\ 1 & -1 \\ -1 & 1 \end{bmatrix} \tag{8}$$

```
> wB  := w.B;
  mwB  := -w.B;

  mwC  := -w.C;

  wD  := w.D;
  mwD  := -w.D;

  wrA  := w.rA;
```

$$wB := \begin{bmatrix} -1 & -1 & 1 \\ 1 & 1 & -1 \\ 1 & 1 & -1 \\ -1 & -1 & 1 \end{bmatrix}$$

$$mwB := \begin{bmatrix} 1 & 1 & -1 \\ -1 & -1 & 1 \\ -1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$$

$$mwC := \begin{bmatrix} 1 & -1 \\ -1 & 1 \\ -1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$wD := \begin{bmatrix} -1 & 1 \\ 1 & -1 \\ 1 & -1 \\ -1 & 1 \end{bmatrix}$$

$$mwD := \begin{bmatrix} 1 & -1 \\ -1 & 1 \\ -1 & 1 \\ 1 & -1 \end{bmatrix}$$

$$wrA := \begin{bmatrix} -1 & -1 & -1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \\ -1 & -1 & -1 \end{bmatrix} \tag{9}$$

```
> X_saru := ArrayTools[Concatenate](2,
  xA, xC, mxA, mxC, mxrB,
  mxC, mxA, xC, yA, xD,
  yA, xD, yA, xD, yB, yD,
  myB, yrC, myB, yD, yB,
  myD, zA, zC, mzA, zrD, mzA,
  zC, zA, mzC, mzB, mwC,
  mzB, mwC, mzB, mwC, wB,
  wD, mwB, mwD, wrA,
  mwD, mwB, wD
  );
```

$$X\_saru := \begin{bmatrix} 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & 1 & \dots \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & 1 & \dots \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & 1 & \dots \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & 1 & \dots \end{bmatrix} \tag{10}$$

$4 \times 110\ \text{Matrix}$

```
> X := convert(LinearAlgebra[Row](X_saru,1),list);
```

$X := [1, 1, 1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, 1,$    **(11)**
$-1, 1, 1, 1, 1, -1, 1, 1, 1, 1, -1, 1, 1, -1, 1, -1, -1, -1, 1, -1, 1, -1, -1, 1, 1, -1, 1,$
$1, -1, -1, 1, -1, -1, -1, -1, 1, 1, 1, 1, 1, -1, 1, 1, 1, -1, 1, -1, -1, -1, 1, -1, 1, 1,$
$-1, 1, -1, 1, 1, -1, 1, -1, 1, 1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, -1, 1, -1, -1, -1,$
$-1, 1, -1, 1, 1, -1, -1, 1]$

```
> Y := convert(LinearAlgebra[Row](X_saru,2),list);
```

$Y := [1, 1, 1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, 1,$    **(12)**
$-1, 1, 1, 1, 1, -1, 1, 1, 1, 1, -1, 1, 1, -1, 1, -1, -1, -1, 1, -1, 1, -1, -1, 1, 1, -1, 1,$
$1, -1, -1, 1, 1, 1, 1, 1, -1, -1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, -1, 1, -1,$
$-1, 1, -1, 1, -1, -1, 1, -1, 1, -1, -1, 1, -1, 1, 1, 1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1,$
$1, 1, -1, 1, -1, -1, 1, 1, -1]$

```
> Z := convert(LinearAlgebra[Row](X_saru,3),list);
```

$Z := [1, 1, 1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, -1, -1, -1,$    **(13)**
$-1, 1, -1, -1, -1, -1, 1, -1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, -1, 1, -1,$
$1, 1, -1, -1, 1, -1, -1, 1, 1, -1, -1, -1, -1, -1, 1, 1, 1, 1, 1, -1, 1, 1, 1, -1, 1, -1,$

$$-1, -1, 1, -1, 1, 1, -1, -1, 1, 1, 1, -1, -1, 1, 1, 1, -1, -1, 1, 1, 1, -1, 1, -1, -1,$$
$$-1, 1, -1, 1, 1, 1, 1, -1, 1, -1, -1, 1, 1, -1 ]$$

```
> W := convert(LinearAlgebra[Row](X_saru,4),list);
```

$W := [1, 1, 1, 1, -1, -1, -1, -1, -1, 1, 1, -1, -1, -1, 1, -1, -1, -1, 1, -1, -1, -1,$   **(14)**

$$-1, 1, -1, -1, -1, -1, 1, -1, -1, -1, -1, 1, -1, -1, -1, 1, -1, 1, 1, 1, -1, 1, -1,$$

$$1, 1, -1, -1, 1, -1, -1, 1, 1, -1, 1, 1, 1, 1, -1, -1, -1, -1, -1, 1, -1, -1, -1, 1,$$

$$-1, 1, 1, 1, -1, 1, -1, -1, 1, 1, -1, -1, -1, 1, 1, -1, -1, -1, 1, 1, -1, -1, -1, 1,$$

$$-1, 1, 1, 1, -1, 1, -1, -1, -1, -1, 1, -1, 1, 1, -1, -1, 1 ]$$

```
> map(nops,[X,Y,Z,W]);
```

$$[110, 110, 110, 110]$$   **(15)**

```
> for s from 1 to 109 do
  s, NPAF(X,s)+NPAF(Y,s)+NPAF(Z,s)+NPAF(W,s);
  od;
```

$$1, 0$$
$$2, 0$$
$$3, 0$$
$$4, 16$$
$$5, -32$$
$$6, 16$$
$$7, 0$$
$$8, 0$$
$$9, -8$$
$$10, 16$$
$$11, -16$$
$$12, 0$$
$$13, 16$$
$$14, -8$$
$$15, 0$$
$$16, -8$$
$$17, 0$$
$$18, 16$$
$$19, -8$$
$$20, 0$$
$$21, -8$$
$$22, 0$$
$$23, 16$$
$$24, -8$$
$$25, 0$$
$$26, 0$$

27, 0

28, 0

29, 0

30, 0

31, 0

32, 0

33, 0

34, 0

35, 0

36, 0

37, 0

38, 0

39, 0

40, 0

41, 0

42, 0

43, 0

44, 0

45, 0

46, 0

47, 0

48, 0

49, 0

50, 0

51, 0

52, 0

53, 0

54, 0

55, 0

56, 0

57, 0

58, 0

59, 0

60, 0

61, 0

62, 0

63, 0

64, 0

65, 0

66, 0

67, 0

68, 0

69, 0

70, 0

71, 0

72, 0

73, 0

74, 0

75, 0

76, 0

77, 0

78, 0

79, 0

80, 0

81, 0

82, 0

83, 0

84, 0

85, 0

86, 0

87, 0

88, 0

89, 0

90, 0

91, 0

92, 0

93, 0

94, 0

95, 0

96, 0

97, 0

98, 0

99, 0

100, 0

101, 0

102, 0

$$103, 0$$
$$104, 0$$
$$105, 0$$
$$106, 0$$
$$107, 0$$
$$108, 0$$
$$109, 0 \qquad \qquad \textbf{(16)}$$

>