

Appendix A

A computer program to compute the least squares estimates of parameters and their corresponding residual by using the classical adjustment method.

Program written in turbo Pascal language

A: is the coefficient matrix of parameters of dimension($n \times m$).

b: is the vector matrix of constant of dimension($n \times 1$).

W: is the weight matrix of dimension($n \times n$).

```
PROGRAMM CLASSICAL;
```

```
USES CRT;
```

```
TYPE
```

```
MAT= ARRAY [1..20,1..20] OF REAL;
```

```
VECTOR= ARRAY [1..20] OF REAL;
```

```
VAR
```

```
N, M, I, J, K: INTEGER;
```

```
A, b, W, AT, ATW, ATWA, IATWA, ATWb, XHAT, ATWAATW, ATWAATWb,
ATWV, V : MAT;
```

```
SUM: REAL;
```

```
XH: VECTOR;
```

```
BEGIN
```

```
CLRSCR;
```

```
WRITELN ('INPUT NO OF OBSERVATIONS');
```

```
READ (N);
```

```
WRITELN ('INPUT NO OF UNKNOWNNS');
```

```
READ (M);
```

```
WRITELN ('INPUT MATRIX A');
```

```
FOR I:=1 TO N DO
```

```
FOR J:=1 TO M DO
```

```
READ (A[I,J]);
```

```
FOR I:= 1 TO N DO
```

```
BEGIN
```

```
FOR J:= 1 TO M DO
```

```
BEGIN
```

```
WRITE (A[I,J]:10:3);
```

```
END; WRITELN; END;
```

```

WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO N DO
BEGIN
AT [I,J]:=A[J,I];
END;
FOR I:= 1 TO M DO
BEGIN
FOR J:= 1 TO N DO
BEGIN
WRITE (AT [I,J]:10:3); END; WRITELN; END;
WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX W');
FOR I:=1 TO N DO
FOR J:=1 TO N DO
READ (W[I,J]);
FOR I:= 1 TO N DO
BEGIN
FOR J:= 1 TO N DO
BEGIN
WRITE (W[I,J]:10:3);
END; WRITELN; END;
WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX b');
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
READ (b[I,J]);
FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN

```

```
WRITE (b[I,J]:10:3);
END; WRITELN;
END; WRITELN; WRITELN;
FOR I:=1 TO M DO
  FOR J:=1 TO N DO
    FOR K:=1 TO N DO
      BEGIN
        ATW[I,J]:=(ATW[I,J]+(AT[I,K])*W[K,J]);
      END;
    FOR I:=1 TO M DO
      BEGIN
        FOR J:=1 TO N DO
          BEGIN
            WRITE (ATW [I,J]:10:3,"");
          END;
        WRITELN; READLN; END;
        WRITELN; WRITELN;
      FOR I:=1 TO M DO
        FOR J:=1 TO M DO
          FOR K:=1 TO N DO
            BEGIN
              ATWA[I,J]:= (ATWA[I,J]+(ATW[I,K])*A[K,J]);
            END;
          FOR I:=1 TO M DO
            BEGIN
              FOR J:=1 TO M DO
                BEGIN
                  WRITE (ATWA [I,J]:10:3,"");
                END;
              WRITELN; READLN; END;
            FOR I:=1 TO M DO
              BEGIN
                SUM:=ATWA[I,I];
                ATWA [I,I]:=1;
              FOR J:=1 TO M DO
```

```

ATWA [I,J]:=(ATWA[I,J])/(SUM);
FOR K:=1 TO M DO
BEGIN
IF (K<>I) THEN
BEGIN
SUM:=ATWA[K,I];
ATWA [K,I]:=0;
FOR J:=1 TO M DO
ATWA [K,J]:=(ATWA[K,J])-SUM*ATWA[I,J];
END; END; END;
WRITELN ('ATWAINV=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
WRITE (' ', ATWA [I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO M DO
FOR J:=1 TO N DO
FOR K:=1 TO M DO
BEGIN
ATWAATW [I,J]:=ATWAATW[I,J]+ATWA[I,K]*ATW[K,J];
END;
WRITELN;
WRITELN (' ATWAATW [IJ],[IK]=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO N DO
WRITE (ATWAATW [I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO N DO
BEGIN
ATWAATWb [I,J]:= ATWAATWb [I,J]+ATWAATW[I,K]*b[K,J];
WRITE (ATWAATW [I,K]:10:3,"");

```

```

WRITELN; READLN; END;

J:=1;
FOR I:=1 TO M DO
BEGIN
WRITE ('XHAT ('I,')=' , ATWAATWb[I,j]:10:3,"");
WRITELN; READLN; END;

FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
AATWAATWb[I,J]:=AATWAATWb[I,J]+A[I,K]*ATWAATWb[K,J];
END; WRITELN;

FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
XH [I]:=ATWAATWb[I,J];
WRITE (AATWAATWb[I,J]:10:3,"");
WRITELN; READLN; END;

FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
BEGIN
V[I,J]:=V[I,J]+AATWAATWb[i,j]-B[i,j];
END; WRITELN;

FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
WRITE('V('I,')=' ,V[I,J]:10:3,"");
WRITELN; END;

FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO N DO
BEGIN
ATWV [I,J]:=ATWV[I,J]+ATW[I,K]*V[K,J];
END;

WRITELN ('CHECK SHOULD=0');

```

```
FOR I:=1 TO M DO  
BEGIN  
  FOR J:=1 TO 1 DO  
    WRITE (ATWV [I,J]:10:3,"");  
  WRITELN; END;  
  READLN; READLN;  
END.
```

Appendix B

A computer programs to compute the least squares estimates of parameters and their corresponding residuals by using the constraint equation method.

Program written in turbo Pascal language

R: is a constraint matrix.

PROGRAM CONSTRAINT;

USES CRT;

MAT= ARRAY [1..20,1..20] OF REAL;

VECTOR= ARRAY [1..20] OF REAL;

VAR

N, M, I, J, K: INTEGER;

A, b, W, AT, ATW, ATWA, IATWA, ATWb, XHAT, ATWAATW, ATWAATWb,

ATWV,V,ATWARRT,ATWARRTATWA,ATWARRTATWAATWARRT,ATWARRTAT

WAATWARRTATW,ATWARRTATWAATWARRTATWb,AATWARRTATWAATWA

RRTATW : MAT;

SUM: REAL;

XH: VECTOR;

BEGIN

CLRSCR;

Writeln ('INPUT NO OF OBSERVATIONS');

READ (N);

Writeln ('INPUT NO OF UNKNOWN'S');

READ (M);

Writeln ('INPUT MATRIX A');

FOR I:=1 TO N DO

FOR J:=1 TO M DO

READ(A[I,J]);

FOR I:= 1 TO N DO

BEGIN

FOR J:= 1 TO M DO

BEGIN

WRITE(A[I,J]:10:3);

END; Writeln; END;

Writeln;Writeln;

FOR I:=1 TO M DO

```

FOR J:=1 TO N DO
BEGIN
AT[I,J]:=A[J,I];
END;
FOR I:= 1 TO M DO
BEGIN
FOR J:= 1 TO N DO
BEGIN
WRITE (AT[I,J]:10:3);
END; WRITELN; END; WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX W');
FOR I:=1 TO N DO
FOR J:=1 TO N DO
READ (W[I,J]);
FOR I:= 1 TO N DO
BEGIN
FOR J:= 1 TO N DO
BEGIN
WRITE (W[I,J]:10:3);
END; WRITELN; END;
WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX b');
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
READ (b[I,J]);
FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (b[I,J]:10:3);
END; WRITELN; END;

```

```

WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX R');
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
READ (R [I,J]);
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (R[I,J]:10:3);
END; WRITELN;
END; WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO M DO
BEGIN
RT[I,J]:=R[J,I];
END;
FOR I:= 1 TO 1 DO
BEGIN
FOR J:= 1 TO M DO
BEGIN
WRITE (RT[I,J]:10:3);
END; WRITELN; END;
WRITELN ('*****');
WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
FOR K:=1 TO 1 DO
BEGIN
RRT[I,J]:=(RRT[I,J]+(R[I,K])*RT[K,J]);
END;
FOR I:=1 TO M DO

```

```

BEGIN
FOR J:=1 TO M DO
BEGIN
WRITE (RRT[I,J]:10:3,"");
END; WRITELN; READLN; END; WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO N DO
FOR K:=1 TO N DO
BEGIN
ATW[I,J]:=(ATW[I,J]+(AT[I,K])*W[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO N DO
BEGIN
WRITE (ATW [I,J]:10:3,"");
END; WRITELN; READLN;
END;
WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
FOR K:=1 TO N DO
BEGIN
ATWA[I,J]:=(ATWA[I,J]+(ATW[I,K])*A[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
BEGIN
WRITE (ATWA [I,J]:10:3,"");
END; WRITELN; READLN;
END;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
BEGIN

```

```

ATWARRT[I,J]:=(ATWARRT[I,J]+(ATWA[I,J])+RT[I,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M
DO
BEGIN
WRITE (ATWARRT [I,J]:10:3,"");
END;
WRITELN; READLN; END;
WRITELN; WRITELN;
FOR I:=1 TO M DO
BEGIN
SUM:=ATWARRT[I,I];
ATWARRT [I,I]:=1;
FOR J:=1 TO M DO
ATWARRT [I,J]:=(ATWARRT[I,J])/(SUM);
FOR K:=1 TO M DO
BEGIN
IF(K<>I)THEN
BEGIN
SUM:=ATWARRT[K,I];
ATWARRT [K,I]:=0;
FOR J:=1 TO M DO
ATWARRT [K,J]:=(ATWARRT[K,J])-SUM*ATWARRT[I,J];
END; END; END;
WRITELN ('ATWARRTINV=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
WRITE ( ' ', ATWARRT [I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
FOR K:=1 TO M DO

```

```

BEGIN
ATWARRTATWA[I,J]:=(ATWARRTATWA[I,J]+(ATWARRT[I,K])*ATWA[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
BEGIN
WRITE (ATWARRTATWA [I,J]:10:3,"");
END; WRITELN; READLN;
END;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
FOR K:=1 TO M DO
BEGIN
ATWARRTATWAATWARRT[I,J]:=(ATWARRTATWAATWARRT[I,J]+
(ATWARRTATWA[I,K])*ATWARRT[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
BEGIN
WRITE (ATWARRTATWAATWARRT [I,J]:10:3,"");
END;
WRITELN; READLN; END;
WRITELN ('*****');
FOR I:=1 TO M DO
FOR J:=1 TO N DO
FOR K:=1 TO M DO
BEGIN
ATWARRTATWAATWARRTATW[I,J]:=ATWARRTATWAATWARRTATW[I,J]
+ATWARRTATWAATWARRT[I,K]*ATW[K,J];
END; WRITELN;
WRITELN (' ATWARRTATWAATWARRTATW [IJ],[IK]=');
FOR I:=1 TO M DO
BEGIN

```

```

FOR J:=1 TO N DO
WRITE (ATWARRTATWAATWARRTATW [I,J]:10:3,"");
WRITELN; READLN;END;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO N DO
BEGIN
ATWARRTATWAATWARRTATWb[I,J]:=ATWARRTATWAATWARRTATWb [I,J]
+ATWARRTATWAATWARRTATW[I,K]*b[K,J];
WRITE (ATWARRTATWAATWARRTATW [I,K]:10:3,"");
WRITELN; READLN; END;
J:=1;
FOR I :=1 TO M DO
BEGIN
WRITE ('XHAT ('I,')=', ATWARRTATWAATWARRTATWb [I,j]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
AATWARRTATWAATWARRTATWb[I,J]:=AATWARRTATWAATWARRTATWb
[I,J]+A[I,K]* ATWARRTATWAATWARRT ATWb [K,J];
END ; WRITELN;
FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
XH[I]:=ATWARRTATWAATWARRTATWb[I,J];
WRITE (AATWARRTATWAATWARRTATWb[I,J]:10:3,"");
WRITELN; READLN;END;
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
BEGIN
V[I,J]:=V[I,J]+ AATWARRTATWAATWARRT ATWb [I,J]-b[I,J];
END; WRITELN;
FOR I:=1 TO N DO

```

```
BEGIN
FOR J:=1 TO 1 DO
WRITE('V(',I,')=' ,V[I,J]:10:3,"");
WRITELN; END;
WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO N DO
BEGIN
ATWV [I,J]:=ATWV[I,J]+ATW[I,K]*V[K,J];
END;
WRITELN ('CHECK SHOULD=0');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
WRITE (ATWV[I,J]:10:3,"");
WRITELN; END;
READLN; READLN;
END.
```

Appendix C

A computer program to compute the least squares estimates of parameters and their corresponding residuals by using the Helmert-Wolf method.

Program written in turbo Pascal language.

```
PROGRAM HELMERT;
USES CRT;
MAT= ARRAY [1..20,1..20] OF REAL;
VECTOR= ARRAY [1..20] OF REAL;
VAR
N, M, I, J, K: INTEGER;
A,b, U, V, C, AT, XHAT IATWA, ATWA, ATWb, ATWAATW, ATWAATWb,
AATWAATWb, ATWV, R, Q, S, SQ, RSQ,G, RT, RTATWA, RTATWAR,
RTATWAATWb, ATWAG,AATWAG: MAT;
XH:VECTOR;
SUM: REAL;
BEGIN
CLRSCR;
Writeln ('INPUT NO OF OBSERVATIONS');
READ (N);
Writeln ('INPUT NO OF UNKNOWNNS');
READ (M);
Writeln ('INPUT MATRIX A');
FOR I:=1 TO N DO
FOR J:=1 TO M DO
READ (A[I,J]);
FOR I:= 1 TO N DO
BEGIN
FOR J:= 1 TO M DO
BEGIN
WRITE (A[I,J]:10:3);
END; Writeln; END; Writeln; Writeln;
FOR I:=1 TO M DO
FOR J:=1 TO N DO
BEGIN
AT [I,J]:=A[J,I];
END;
FOR I:= 1 TO M DO
BEGIN
```

```

FOR J:= 1 TO N DO
BEGIN
WRITE (AT[I,J]:10:3);
END; WRITELN; END; WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX W');
FOR I:=1 TO N DO
FOR J:=1 TO N DO
READ (W[I,J]);
FOR I:= 1 TO N DO
BEGIN
FOR J:= 1 TO N DO
BEGIN
WRITE (W[I,J]:10:3);
END; WRITELN; END; WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
WRITELN ('INPUT MATRIX b');
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
READ (b[I,J]);
FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (b[I,J]:10:3);
END; WRITELN; END; WRITELN; WRITELN;
WRITELN ('INPUT MATRIX C');
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
READ(C[I,J]);
FOR I:= 1 TO 1 DO
BEGIN
FOR J:= 1 TO 1 DO

```

```

BEGIN
WRITE(C[I,J]:10:3);
END;
FOR I:=1 TO M DO
FOR J:=1 TO N DO
FOR K:=1 TO N DO
BEGIN
ATW[I,J]:=(ATW[I,J]+(AT[I,K])*W[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO N DO
BEGIN
WRITE (ATW [I,J]:10:3,"");
END; WRITELN; READLN; END; WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO N DO
BEGIN
ATWb [I,J]:=( ATWb[I,J]+(ATW[I,K])*b[K,J]);
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (ATWb[I,J]:10:3,"");
END; WRITELN; READLN; END;
WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
BEGIN
U[I,J]:= ATWb [I,J];
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO

```

```

BEGIN
WRITE (U[I,J]:10:3,"");
END; WRITELN; READLN; END;
WRITELN ('INPUT MATRIX R');
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
READ (R[I,J]);
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE(R[I,J]:10:3);
END; WRITELN; END; WRITELN; WRITELN;
WRITELN ('*****');
WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO M DO
BEGIN
RT [I,J]:=R[J,I];
END;
FOR I:= 1 TO 1 DO
BEGIN
FOR J:= 1 TO M DO
BEGIN
WRITE (RT[I,J]:10:3);
END; WRITELN; END;
WRITELN ('*****');
WRITELN; WRITELN;
FOR I:=1 TO M DO
FOR J:=1 TO M DO
FOR K:=1 TO N DO
BEGIN
ATWA[I,J]:=(ATWA[I,J]+(ATW[I,K])*A[K,J]);
END;
FOR I:=1 TO M DO

```

```

BEGIN
FOR J:=1 TO M DO
BEGIN
WRITE (ATWA [I,J]:10:3,"");
END; WRITELN; READLN; END;
FOR I:=1 TO M DO
BEGIN
SUM:=ATWA[I,I];
ATWA [I,I]:=1;
FOR J:=1 TO M DO
ATWA [I,J]:=(ATWA[I,J])/(SUM);
FOR K:=1 TO M DO
BEGIN
IF(K<>I)THEN
BEGIN
SUM:=ATWA[K,I];
ATWA [K,I]:=0;
FOR J:=1 TO M DO
ATWA [K,J]:=(ATWA[K,J])-SUM*ATWA[I,J];
END; END; END;
WRITELN ('ATWAINV=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO M DO
WRITE ( ' ', ATWA [I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO 1 DO
FOR J:=1 TO M DO
FOR K:=1 TO M DO
BEGIN
RTATWA[I,J]:=RTATWA[I,J]+(RT[I,K])*ATWA[K,J];
END;
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO M DO

```

```

BEGIN
WRITE (RTATWA [I,J]:10:3,"");
END; WRITELN; READLN; END; WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
RTATWAR[I,J]:=RTATWAR[I,J]+(RTATWA[I,K])*R[K,J];
END;
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (RTATWAR [I,J]:10:3,"");
END; WRITELN; READLN; END;
WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
RTATWAATWb[I,J]:=RTATWAATWb[I,J]+(RTATWA[I,K])*ATWb[K,J];
END;
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (RTATWAATWb[I,J]:10:3,"");
END; WRITELN; READLN; END;
WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
Q[I,J]:= RTATWAATWb [I,J]-C[I,J];
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO

```

```

BEGIN
WRITE (Q[I,J]:10:3,"");
END;
WRITELN; READLN; END;
FOR I:=1 TO 1 DO
BEGIN
SUM:=RTATWAR[I,I];
RTATWAR [I,I]:=1;
FOR J:=1 TO 1 DO
RTATWAR [I,J]:=(RTATWAR[I,J])/(SUM);
FOR K:=1 TO 1 DO
BEGIN
IF(K<>I)THEN
BEGIN
SUM:=RTATWAR[K,I];
RTATWAR [K,I]:=0;
FOR J:=1 TO 1 DO
RTATWAR [K,J]:=(RTATWAR[K,J])-SUM*RTATWAR[I,J];
END; END; END;
WRITELN ('RTATWARINV=');
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO
WRITE (' ', RTATWAR [I,J]:10:3,"");
WRITELN; READLN; END;
WRITELN; WRITELN;
S[I,J]:=RTATWAR[I,J];
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO
WRITE (' ',S[I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
FOR K:=1 TO 1 DO

```

```

BEGIN
RTATWAATWb[I,J]:=RTATWAATWb[I,J]+(RTATWA[I,K])*ATWb[K,J];
END;
FOR I:=1 TO 1 DO
BEGIN
FOR J:=1 TO 1 DO
BEGIN
WRITE (RTATWAATWb[I,J]:10:3,"");
END;
WRITELN; READLN; END;
WRITELN; WRITELN;
FOR I:=1 TO 1 DO
FOR J:=1 TO 1 DO
FOR K:=1 TO 1 DO
BEGIN
SQ[I,J]:=SQ[I,J]+S[I,K]*Q[K,J];
END; WRITELN;
WRITELN (' SQ[IJ],[IK]=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO N DO
WRITE (SQ [I,J]:10:3,"");
WRITELN; READLN; END;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO 1 DO
BEGIN
RSQ [I,J]:=RSQ[I,J]+R[I,K]*SQ[K,J];
END; WRITELN;
WRITELN (' RSQ [IJ],[IK]=');
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
WRITE (RSQ [I,J]:10:3,"");
WRITELN; READLN;END;

```

```

FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
BEGIN
G[I,J]:=U[I,J]-RSQ[I,J];
END;
FOR I:=1 TO M DO
BEGIN
FOR J:=1 TO 1 DO
WRITE (G[I,J]:10:3,"");
Writeln; Readln; END;
FOR I:=1 TO M DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
ATWAG [I,J]:=ATWAG[I,J]+ATW[I,K]*G[K,J];
WRITE (ATWAG [I,K]:10:3,"");
Writeln; Readln; END;
J:=1;
FOR I:=1 TO M DO
BEGIN
WRITE('XHAT(',I,')=',ATWAG[I,j]:10:3,"");
Writeln; Readln; END;
FOR I:=1 TO N DO
FOR J:=1 TO 1 DO
FOR K:=1 TO M DO
BEGIN
AATWAG [I,J]:=AATWAG[I,J]+A[I,K]*ATWAG[K,J];
END; Writeln;
FOR I:=1 TO N DO
BEGIN
FOR J:=1 TO 1 DO
XH[I]:=ATWAG[I,J];
WRITE (AATWAG [I,J]:10:3,"");
Writeln; Readln; END; Readln; Readln; END; END; END.

```

