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航空機 소티획당 프로그램

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서 정 대 *

이 프로그램은 3. 解法의 참고문헌에 소개된 Two Optimal Sortie Allocation Models 의 하나로써 조금 수정하여 공개하는 것이다.

1. 프로그램 이름 : SORTA

2. 目的

이 프로그램은 Blue 팀과 Red 팀이 교전상태에 있을 때 一般目的用 전투기를

(1) 전투지원 (Combat Air Support : CAS)

(2) 기지 폭파 (Airbase Attack : ABA)

(3) 공중 방어 (Intercept : INT)에 어떻게 할당하는 것이 最適인가를 구하는데 사용 되는 프로그램이다.

여기서 사용하는 效用測度 (Measure of Effectiveness : MOE)는 세가지를 사용하고 있는데 이들은

(1) MOE 1 : FEBA의 위치

(2) MOE 2 : Blue의 空·地上화력의 누적습에서 Red의 것을 뺀 것

(3) MOE 3 : Blue의 공중火力的 누적습에서 Red의 것을 뺀 것

이다. 이들 세가지의 MOE를 사용하여 전투기간을 90일로 잡고 10일, 30일, 90일에

전투기의 최적배치를 구한다. 즉 이 프로그램은 각 MOE를 사용할때 상기 3가지 기간에 있어서 전투기의 CAS, ABA, INT에의 最適배치를 구할 수 있다.

3. 解 法

(1) 이 프로그램은 3가지 MOE를 각각 사용할 때 전투 시작후 10일, 30일, 90일에서의 전투기의 배치를 구해야 함으로 결국 전투기배치 戰略은 9가지 경우에 대해 구해야 한다. 즉

1기간 (즉 10일) + MOE 1

2기간 (즉 30일) + MOE 1

3기간 (즉 90일) + MOE 1

1기간 + MOE 2

2기간 + MOE 2

3기간 + MOE 2

1기간 + MOE 3

2기간 + MOE 3

3기간 + MOE 3

그래서 이들 9가지의 경우에 있어서 최적배치를 구하기 위하여 다음 9가지의 MOE를 사용한다. 즉

① τ_1 기간의 FEBA 위치

② τ_2 기간의 FEBA 위치

③ τ_3 기간의 FEBA 위치

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- ④ τ_1 기간의 BLUE의 공중과 지상화력의 누적합에서 RED의 공중과 지상화력의 누적합을 뺀것
- ⑤ τ_2 기간의 BLUE의 공중과 지상화력의 누적합에서 RED의 것을 뺀것
- ⑥ τ_3 기간의 BLUE의 공중과 지상화력의 누적합에서 RED의 것을 뺀것
- ⑦ τ_1 기간의 BLUE의 공중화력의 누적합에서 RED의 것을 뺀것
- ⑧ τ_2 기간의 BLUE의 공중화력의 누적합에서 RED의 것을 뺀것
- ⑨ τ_3 기간의 BLUE의 공중화력의 누적합에서 RED의 것을 뺀것

(2) BLUE와 RED의 작전력에 대해 이득행렬을 구하기 위해서는 먼저 아래의 변수를 정의한다.

- $U_{kt} = t$ 기간, k 유형의 BLUE 사단
- $V_{lt} = t$ 기간, l 유형의 RED 사단
- $X_{mt} = t$ 기간, m 유형의 BLUE 항공기
 - ($m = 1$: 일반용도 항공기
 - $m = 2$: 전투용 항공기
 - $m = 3$: 기지폭파용 항공기
 - $m = 4$: 방어용 항공기)
- $Y_{nt} = t$ 기간, n 유형의 RED 항공기
 - ($n = 1$: 일반용도 항공기
 - $n = 2$: 전투용 항공기
 - $n = 3$: 기지폭파용 항공기
 - $n = 4$: 방어용 항공기

- $a_k = k$ 유형의 BLUE 사단당 화력
- $b_l = l$ 유형의 RED 사단당 화력
- $c_m = m$ 유형의 BLUE 전투용 항공기당화력
- $d_n = n$ 유형의 RED 전투용 항공기당화력
- $f(\cdot) =$ 단위기간당 BLUE 화력 대 RED 화력의 비율함수로 나타내어지는 FEBA 위치

- $\alpha_{1t}, \alpha_{2t}, \alpha_{3t} = t$ 기간의 전투용, 기지폭파용, 방어용에 배치되는 BLUE의 일반용도 항공기의 비율
- $\beta_{1t}, \beta_{2t}, \beta_{3t} = t$ 기간의 전투용, 기지폭파용, 방어용에 배치되는 RED의 일반용도 항공기의 비율

MOE에 따른 이득행렬을 구하기 위해서는 다음과 같은 계산이 필요하다.

- ① t 기간의 초기 사단수

$$U_{kt} = U_{k,t-1} - U_{k,t-1}^d + U_{kt}^a, \forall k$$

$$V_{lt} = V_{l,t-1} - V_{l,t-1}^d + V_{lt}^a, \forall l$$

여기서 d : 파괴, a : 추가를 의미

- ② t 기간의 지상화력

$$G_t^B = \sum_k U_{kt} a_k$$

$$G_t^R = \sum_l V_{lt} b_l$$

- ③ t 기간의 초기 항공기수

$$X_{mt} = X_{m,t-1} - X_{m,t-1}^d + X_{mt}^a, \forall m$$

$$Y_{nt} = Y_{n,t-1} - Y_{n,t-1}^d + Y_{nt}^a, \forall n$$

- ④ t 기간의 항공기 배치

$$X_{1t}^B = \alpha_{1t} X_{1t} \text{ (BLUE GP} \rightarrow \text{CAS)}$$

$$X_{1t}^R = \alpha_{2t} X_{1t} \text{ (BLUE GP} \rightarrow \text{ABA)}$$

$$X_{1t}^I = \alpha_{3t} X_{1t} \text{ (BLUE GP} \rightarrow \text{INT)}$$

$$X_{2t}^B = X_{2t} \text{ (BLUE CAS} \rightarrow \text{CAS)}$$

$$X_{3t}^B = X_{3t} \text{ (BLUE ABA} \rightarrow \text{ABA)}$$

$$X_{4t}^B = X_{4t} \text{ (BLUE INT} \rightarrow \text{INT)}$$

$$Y_{1t}^R = \beta_{1t} Y_{1t} \text{ (RED GP} \rightarrow \text{CAS)}$$

$$Y_{1t}^I = \beta_{2t} Y_{1t} \text{ (RED GP} \rightarrow \text{ABA)}$$

$$Y_{1t}^D = \beta_{3t} Y_{1t} \text{ (RED GP} \rightarrow \text{INT)}$$

$$Y_{2t}^R = Y_{2t} \text{ (RED CAS} \rightarrow \text{CAS)}$$

$$Y_{3t}^R = Y_{3t} \text{ (RED ABA} \rightarrow \text{ABA)}$$

$$Y_{4t}^R = Y_{4t} \text{ (RED INT} \rightarrow \text{INT)}$$

- ⑤ t 기간의 공중화력

$$A_t^B = X_{1t}^B c_1 + X_{2t}^B c_2$$

$$A_t^R = Y_{1t}^R d_1 + Y_{2t}^R d_2$$

- ⑥ t 기간의 전체화력

$$T_t^B = G_t^B + A_t^B$$

$$T_t^R = G_t^R + A_t^R$$

- ⑦ t 기간의 FEBA 위치

$$FEBA_t = FEBA_{t-1} + f \left(\frac{T_t^B}{T_t^R} \right)$$

- ⑧ t 기간의 누적전체화력

$$CT_t^B = CT_{t-1}^B + T_t^B$$

$$CT_t^R = CT_{t-1}^R + T_t^R$$

- ⑨ t 기간의 누적공중화력

$$CA_t^B = CA_{t-1}^B + A_t^B$$

$$CA_t^R = CA_{t-1}^R + A_t^R$$

- (3) 이 모형의 解를 구하기 위해서 행렬계임

을 선형계획 문제로 바꾸어 單體法 (simplex method) 를 사용한다.

다음과 같은 이득행렬이 주어졌다고 하자.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

$$= (a_{ij})_{(i,j) \in M \times N}$$

참가자 1의 문제는 다음과 같은 선형계획법으로 바뀐다. 참가자 1의 안전수준을 L이라고 할때,

$$\begin{aligned} \text{Max. } L \\ \text{s.t. } XA \geq L e_n \\ e_m X = 1 \\ X \geq 0 \end{aligned}$$

참가자 2의 안전수준을 L'라고 할때

$$\begin{aligned} \text{Min. } L' \\ \text{s.t. } AY \leq L' e_m \\ e_n Y = 1 \\ Y \geq 0 \end{aligned}$$

로 변환된다.

이 Model에서

① RED :

$$\begin{aligned} \text{Max } y_1 + y_2 + \cdots + y_n \\ \text{s.t. } AY \leq 1 \\ Y \geq 0 \end{aligned}$$

$$\begin{aligned} \rightarrow \text{Min } -y_1 - y_2 - \cdots - y_n \\ \text{s.t. } AY \leq 1 \\ Y \geq 0 \end{aligned}$$

여기서 $v = 1 / -\sum_{j=1}^n y_j$ 와 y^* 그리고

x^* 를 구해낸다.

② BLUE :

$$\begin{aligned} \text{Min } v \\ \sum_{i=1}^m AY \leq v \\ \sum_{i=1}^m y_i = 1 \end{aligned}$$

$$\begin{aligned} \rightarrow \text{Max } y_1' + y_2' + \cdots + y_m' \\ \text{s.t. } AY' \leq 1 \\ y_j' = y_j / v \geq 0 \end{aligned}$$

으로 된다.

4. 참고문헌

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- _____, 線型計劃法, 大英社, 1983
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5. 구조와 주요변수

<구조>

- (1) Subroutine READ: 입력자료를 읽어 들인다.
- (2) Subroutine CAM: 자료를 계산한다.
- (3) Subroutine CVFX: 보충계산을 한다.
- (4) Subroutine PR1: 출력을 명령한다.
- (5) Subroutine PR2: 출력을 명령한다.
- (6) Subroutine GAMES: 행렬게임으로부터 게임값을 계산한다.
- (7) Subroutine SIMPX: 單體法을 수행한다.
- (8) Subroutine PGAME: 게임값 출력을 명령한다.

<주요변수>

(1) 입력변수

NKBD: BLUE 사단의 종류수

NKRD: RED 사단의 종류수

NKBA: BLUE 항공기의 종류수

NKRA: RED 항공기의 종류수

NID: 기간

NIBP, IBPM(4): BLUE의 공중배치 기간수, 기간중 최고일

NIRP, IRPH(4): RED의 공중배치 기간횟수, 기간중 최고일

NIAB: BLUE의 배치 숫자

NIAR: RED의 배치 숫자

IPR1, IPR2: Print 1을 지시
Print 2를 지시

IREPL: 지상보충의 지표

(0=보충 없음

1=모두 보충)

BDA (KBD, ID) : 추가되는 BLUE 사단 (BLUE 사단 종류, 날짜)
 RDA(KRD, ID) : 추가되는 RED사단 (RED 사단종류, 날짜)
 BAA(KBA, ID) : 추가되는 BLUE 항공기 (항공기 종류, 날짜)
 RAA(KRA, ID) : 추가되는 RED항공기 (항공기 종류, 날짜)
 BSHEL : BLUE 방공호
 RSHEL : RED 방공호
 FBD(KBD) : BLUE 사단당 화력 (BLUE 사단 종류)
 FRD(KRD) : RED 사단당 화력 (RED 사단의 종류)
 FBA(KBA) : BLUE 항공기당 화력 (BLUE 항공기 종류)
 FRA(KRA) : RED 항공기당 화력 (RED 항공기 종류)
 BDKRA, BAKRD : BLUE 수비가 RED 공격자를 파괴할, BLUE 공격이 RED 수비자를 파괴할 계수
 RDKBA, RAKBD : RED 수비가 BLUE 공격자를 파괴할, RED 공격이 BLUE 수비자를 파괴할 계수
 BR21A, BR21B, BR23A, BR23B : BLUE가 RED 항공기 - 1, s : 1, NS : 3, S : 3, NS를 파괴할 계수
 RB21A, RB21B, RB23A, RB23B : RED가 BLUE 항공기 - 1, S ; 1, NS ; 3, S ; 3, NS를 파괴할 계수
 NFRFA, FRFA(I), FA(I) : FEBA 진전을 위한 화력 비율의 수, 화력비율, FEBA 진전
 NFRBD, FRBD(I), BD(I) : BLUE 파괴를 위한 화력 비율의 수, 화력비율, BLUE 파괴
 NFRRD, FRRD(I), RD(I) : RED 파괴를 위한 화력 비율의 수, 화력비율, RED 파괴

PBA1(IAB, IBP) : BLUE 항공기의 CAS 비율 (BLUE 할당, 기간)
 PBA2(IAB, IBP) : BLUE 항공기의 ABA 비율 (BLUE 할당, 기간)
 PBA3(IAB, IBP) : BLUE 항공기의 INT 비율 (BLUE 할당, 기간)
 PRA1(IAR, IRP) : RED 항공기의 CAS 비율 (RED 할당, 기간)
 PRA2(IAR, IRP) : RED 항공기의 ABA 비율 (RED 할당, 기간)
 PRA3(IAR, IRP) : RED 항공기의 INT 비율 (RED 할당, 기간)
 MOE(9) : 호출측정 (게임)
 IDMOE(9) : 효율측정이 해결될지 안 될지를 나타내는 지표 (게임)
 GVA(9) : 單體解에 추가된 게임값 (게임)

(2) 출력변수

A1(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(1)때의 FEBA 위치
 A2(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(2)때의 FEBA 위치
 A3(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(3) 때의 FEBA 위치
 A4(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(4) 때의 지상+공중화력의 차이
 A5(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(5) 때의 지상+공중화력의 차이
 A6(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(6) 때의 지상+공중화력의 차이
 A7(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(7)때의 지상+공중화력의 차이

A8(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(8)의 때 지상+공중화력의 차이

A9(IAB, IAR) : 전략조합 IAB, IAR의 IDMOE(9)의 때 지상+공중화력의 차이

V : 게임값 (GVA 포함)

VALUE : 게임값 (원래 단위)

XP(i) : 선형계획법에서 BLUE 전략 변수의 값

YP(i) : 선형계획법에서 RED 전략 변수의 값

X(I) : BLUE 전략의 가중치

Y(I) : RED 전략의 가중치

6. 使用方法

(1) 入力

카드	入力형태	변수와 내용
1	8 i 10	NKBD, NKRD, NKBA, NKRA
2	8 i 10	NiD
3	8 i 10	NiBP, NiRP, iBPH(i), iRPH(i)
4	8 i 10	NiAB, NiAR
5	8 i 10	iPR1, iPR2
6	8 i 10	iREPL
7-19	8 F 10.0	BDA(KRD, iD)
20-32	8 F 10.0	RDA(KRD, iD)
33-45	8 F 10.0	BAA(KRD, iD)
46-58	8 F 10.0	RAA(KRA, iD)
59	8 F 10.0	BSHEL
60	8 F 10.0	BSHEL
61	8 F 10.1	FBD(KBD)
62	8 F 10.1	FRD(KRD)
63	8 F 10.3	FBA(KBA)
64	8 F 10.3	FRA(KRA)
65	8 F 10.3	BDKRA, BAKRD
66	8 F 10.3	RDKBA, BAKRD
67	8 F 10.3	BR21A, BR21B BR23A, BR23B

카드	入力형태	변수와 내용
68	8 F 10.3	RB21A, RB21B RB23A, RB23B
69	8 i 10	NFRFA
70-71	8 F 10.2	FRFA(I)
72-73	8 F 10.1	FA(I)
74	8 i 10	NFRBD
75-76	8 F 10.2	FRBD(I)
77-78	8 F 10.3	BD(I)
79	8 i 10	NFRRD
80-81	8 F 10.2	FRRD(I)
82-83	8 F 10.3	RD(I)
84-110	8 F 10.2	PBA1(iAB, IBP)
111-137	8 F 10.2	PBA2(IAB, IBP)
138-164	8 F 10.2	PBA3(IAB, IBP)
165-191	8 F 10.2	PRA1(IAR, IRP)
192-218	8 F 10.2	PRA2(IAR, IRP)
219-245	8 F 10.2	PRA3(IAR, IRP)
246-247	8 i 10	MOE(I)
248-249	8 i 10	IDMOE(I)
250-251	8 F 10.1	GVA(I)

(2) 出力

출력은 3群으로 나누어져 나타난다.

① 원자료의 입력치가 출력으로 나타난다.

② 9가지의 MOE에 대한 이득행렬이 계산되어 나타난다.

여기에 單體法을 적용하여 게임값을 구해내며 최적해를 알 수 있다.

③ 9가지의 MOE에 따라 BLUE와 RED의 혼합최적전략이 표시되며 게임값이 계산되어 나타난다.

7. 참고사항

(1) 원 program에서 PR1, PR2 또는 P GAME subroutine 중 필요한 것만 써서 원하는 출력만을 인쇄 할 수 있다.

(2) 이득행렬이 계산되었을 때 MOE1(FE BA position at sub-period 30)에서만 BLUE와 RED의 각 전략에 대한 sorting을 하였다. 사용자의 필요에 따라 첨가 또는

삭제가 가능하다. (Subroutine PR2)

8. 사용례

BLUE 사단에는 한 종류가 있으며, 지금 1일 현재 24개가 있고 10일, 20일, 30일에 4개씩이 첨가되며 모두 36개가 된다. RED 사단도 한 종류가 있고, 1일 현재 80개이며 10일과 20일에 10개씩 추가되어 모두 100개가 된다. 지상전투에서의 모든 파손은 대체되며 따라서 전쟁이 진행되는 동안 사단 화력은 감소하지 않는다.

BLUE 항공기는 한 종류가 있으며 1일에 1,000대, 그리고 10일, 20일, 30일에 400대씩 추가되어 모두 2,200대가 된다. RED 항공기도 한 종류이며 1일에 1,000대, 10일 20일에 600대씩 추가되어 모두 2,200대이다. 방공호는 BLUE에서 500개, RED에서 1,000개가 있다.

BLUE와 RED의 사단당 화력은 10과 6이며 CAS 항공기당 화력은 .1과 .08이다.

BLUE가 RED의 지상항공기중 파괴상태에 있는 것과 아닌 것을 발견하여 파괴할 수 있는 확률은 .4와 .6이다. RED는 .2와 .3이다.

FEBA이동, BLUE 사단 파괴, RED 사단 파괴는 화력비율의 함수이며 다음의 자료에 의해 계산된다.

화력비	FEBA 이동	BLUE 사단파괴	RED 사단파괴
.1	-60	.020	.002
.2	-40	.014	.003
.33	-20	.010	.005
.50	-10	.009	.007
.67	0	.008	.008
1.0	0	.008	.008
1.50	0	.008	.008
2.00	10	.007	.009
3.00	20	.005	.010
5.00	20	.003	.014
10.00	60	.002	.020

BLUE와 RED의 항공기 할당은 CAS와 ABA에만 배치된다. 가능한 조합은 3기간 동안 CAS와 ABA에 1, .5, 0이다. 표 1에 나타내었다. 기간 1은 1일부터 10일까지, 기간 2는 11일부터 30일까지 기간 3은 31일부터 90일까지이다.

표 1 배치전략

戰略	Period					
	1		2		3	
	CAS	ABA	CAS	ABA	CAS	ABA
1	1	0	1	0	1	0
2	1	0	1	0	.5	.5
3	1	0	1	0	0	1
4	1	0	.5	.5	1	0
5	1	0	.5	.5	.5	.5
6	1	0	.5	.5	0	1
7	1	0	0	1	1	0
8	1	0	0	1	.5	.5
9	1	0	0	1	0	1
10	.5	.5	1	0	1	0
11	.5	.5	1	0	.5	.5
12	.5	.5	1	0	0	1
13	.5	.5	.5	.5	1	0
14	.5	.5	.5	.5	.5	.5
15	.5	.5	.5	.5	0	1
16	.5	.5	0	1	1	0
17	.5	.5	0	1	.5	.5
18	.5	.5	0	1	0	1
19	0	1	1	0	1	0
20	0	1	1	0	.5	.5
21	0	1	1	0	0	1
22	0	1	.5	.5	1	0
23	0	1	.5	.5	.5	.5
24	0	1	.5	.5	0	1
25	0	1	0	1	1	0
26	0	1	0	1	.5	.5
27	0	1	0	1	0	1

(2) 入力

1 1 1 1
90
3 3 10 30 90 10 30 90

27 27 (넷째 줄에 해당)
0 1
1

24.	0	0	0	0	0	0	0
0	4.	0	0	0	0	0	0
0	0	0	4.	0	0	0	0
0	0	0	0	0	4.	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
80.	0	0	0	0	0	0	0
0	10.	0	0	0	0	0	0
0	0	0	10.	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1000.	0	0	0	0	0	0	0
0	400.	0	0	0	0	0	0
0	0	0	400.	0	0	0	0
0	0	0	0	0	400.	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1000.	0	0	0	0	0	0	0
0	600.	0	0	0	0	0	0
0	0	0	600.	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0						
500.							
1000.							
10.0							
6.0							
.100							
.080							
.300	.100						
.300	.100						
.400	.600	.400	.600				
.200	.300	.200	.300				
11							
.10	.20	.33	.50	.67	1.00	1.50	2.00
3.00	5.00	10.00					
-60.0	-40.0	-20.0	-10.0	.0	.0	.0	10.0
20.0	40.0	60.0					
11							
.10	.20	.33	.50	.67	1.00	1.50	2.00
3.00	5.00	10.00					
.020	.014	.010	.009	.008	.008	.008	.007
.005	.003	.002					
11							
.10	.20	.33	.50	.67	1.00	1.50	2.00
3.00	5.00	10.00					
.002	.003	.005	.007	.008	.008	.008	.009
.010	.014	.020					
1.00	1.00	1.00			1.00	.00	1.00
1.00	1.00	.50			1.00	.00	.50
1.00	1.00	.00			.50	1.00	1.00
1.00	.50	1.00			.50	1.00	.50
1.00	.50	.50			.50	1.00	.00
1.00	.50	.00			.50	.50	1.00

(좌측 7번째
줄에 해당)

.50	.50	.50	.00	.00	.00	(좌측 맨 밑 줄에 해당)
.50	.50	.00	.00	.00	.00	
.50	.00	1.00	.00	.00	.00	
.50	.00	.50	.00	.00	.00	
.50	.00	.00	.00	.00	.00	
.00	1.00	1.00	.00	.00	.00	
.00	1.00	.50	.00	.00	.00	
.00	1.00	.00	.00	.00	.00	
.00	.50	1.00	.00	.00	.00	
.00	.50	.50	.00	.00	.00	
.00	.50	.00	.00	.00	.00	
.00	.00	1.00	.00	.00	.00	
.00	.00	.50	.00	.00	.00	
.00	.00	.00	.00	.00	.00	
.00	.00	.00	.00	.00	.00	
.00	.00	.50	.00	.00	.00	
.00	.00	1.00	.00	.00	.00	
.00	.50	.00	.00	.00	.00	
.00	.50	.50	.00	.00	.00	
.00	.50	1.00	1.00	1.00	1.00	
.00	1.00	.00	1.00	1.00	.50	
.00	1.00	.50	1.00	1.00	.00	
.00	1.00	1.00	1.00	.50	1.00	
.50	.00	.00	1.00	.50	.50	
.50	.00	.50	1.00	.50	.00	
.50	.00	1.00	1.00	.00	1.00	
.50	.50	.00	1.00	.00	.50	
.50	.50	.50	1.00	.00	.00	
.50	.50	1.00	.50	1.00	1.00	
.50	1.00	.00	.50	1.00	.50	
.50	1.00	.50	.50	1.00	.00	
.50	1.00	1.00	.50	.50	1.00	
1.00	.00	.00	.50	.50	.50	
1.00	.00	.50	.50	.50	.00	
1.00	.00	1.00	.50	.00	1.00	
1.00	.50	.00	.50	.00	.50	
1.00	.50	.50	.50	.00	.00	
1.00	.50	1.00	.00	1.00	1.00	
1.00	1.00	.00	.00	1.00	.50	
1.00	1.00	.50	.00	1.00	.00	
1.00	1.00	1.00	.00	.50	1.00	
.00	.00	.00	.00	.50	.50	
.00	.00	.00	.00	.50	.00	
.00	.00	.00	.00	.00	1.00	
.00	.00	.00	.00	.00	.50	
.00	.00	.00	.00	.00	.00	
.00	.00	.00	.00	.00	.00	
.00	.00	.00	.00	.00	.00	
.00	.00	.00	.00	.00	.50	
.00	.00	.00	.00	.00	1.00	

.00	.50	.00			.00	.00	.00	(좌측행에서 계속됨)
.00	.50	.50			.00	.00	.00	
.00	.50	1.00			.00	.00	.00	
.00	1.00	.00			.00	.00	.00	
.00	1.00	.50			.00	.00	.00	
.00	1.00	1.00			.00	.00	.00	
.50	.00	.00			.00	.00	.00	
.50	.00	.50			.00	.00	.00	
.50	.00	1.00			.00	.00	.00	
.50	.50	.00			.00	.00	.00	
.50	.50	.50			.00	.00	.00	
.50	.50	1.00			.00	.00	.00	
.50	1.00	.00			.00	.00	.00	
.50	1.00	.50			.00	.00	.00	
.50	1.00	1.00			.00	.00	.00	
1.00	.00	.00			.00	.00	.00	
1.00	.00	.50			.00	.00	.00	
1.00	.00	1.00			.00	.00	.00	
1.00	.50	.00			.00	.00	.00	
1.00	.50	.50			.00	.00	.00	
1.00	.50	1.00			.00	.00	.00	
1.00	1.00	.00			.00	.00	.00	
1.00	1.00	.50			.00	.00	.00	
1.00	1.00	1.00			.00	.00	.00	
.00	.00	.00			.00	.00	.00	
1	1	1	1	1	1	1	1	
1								
10	30	90	10	30	90	10	30	
90								

10000. 10000. 10000. 100000. 100000. 100000. 10000. 10000.
10000.

(3) 出力 9개의 MOE에 따른 최적전략과 게임값이 나
출력중 入力자료의 인쇄인 1群과, 각 MOE 타나는 3群중 처음 3경우만을 실어둔다.
에 따른 이득행렬인 2群은 게재를 생략하고

MOE : POSITION OF THE FEBA AT THE END OF SUB-PERIOD 10

VALUE OF GAME (INCLUDING GAME VALUE ADDED FOR SIMPLEX SOLUTION)
9941.28516
VALUE OF GAME (IN ORIGINAL UNIT)
-58.71484

BLUE		RED	
INDEX OF BLUE-STRATEGY VARIABLES	WEIGHT FOR BLUE STRATEGY	INDEX OF RED-STRATEGY VARIABLES	WEIGHT FOR RED STRATEGY
1	1.0000	1	.0020
2	.0000	2	.0000
3	.0000	3	.0000
4	.0000	4	.0000
5	.0000	5	.0000
6	.0000	6	.0000
7	.0000	7	.0000
8	.0000	8	.0000
9	.0000	9	.0000
10	.0000	10	.0168
11	.0000	11	.0168
12	.0000	12	.0168
13	.0000	13	.0168
14	.0000	14	.0168
15	.0000	15	.0168
16	.0000	16	.0168
17	.0000	17	.0168
18	.0000	18	.0168
19	.0000	19	.0941
20	.0000	20	.0941
21	.0000	21	.0941
22	.0000	22	.0941
23	.0000	23	.0941
24	.0000	24	.0941
25	.0000	25	.0941
26	.0000	26	.0941
27	.0000	27	.0941

MOE : POSITION OF THE FEBA AT THE END OF SUB-PERIOD 30

VALUE OF GAME (INCLUDING GAME VALUE ADDED FOR SIMPLEX SOLUTION)

9806.59375

VALUE OF GAME (IN ORIGINAL UNIT)

-193.40625

BLUE		RED	
INDEX OF BLUE-STRATEGY VARIABLES	WEIGHT FOR BLUE STRATEGY	INDEX OF RED-STRATEGY VARIABLES	WEIGHT FOR RED STRATEGY
1	-.0001	1	.0013
2	.0000	2	.0244
3	.0000	3	.0244
4	.0000	4	.0320

5	.0000	5	.0320
6	.0000	6	.0320
7	.0000	7	.0396
8	.0000	8	.0396
9	.0000	9	.0396
10	-.0000	10	.0244
11	.0000	11	.0341
12	.0000	12	.0341
13	.0000	13	.0452
14	.0000	14	.0452
15	.0000	15	.0452
16	.0000	16	.0570
17	.0000	17	.0570
18	.0000	18	.0570
19	-.0000	19	.0073
20	.0000	20	.0073
21	.0000	21	.0073
22	.9999	22	.0341
23	.0000	23	.0000
24	.0000	24	.0000
25	.0000	25	.0932
26	.0000	26	.0932
27	.0000	27	.0932

MOE : POSITION OF THE FEBA AT THE END OF SUB-PERIOD 90

VALUE OF GAME (INCLUDING GAME VALUE ADDED FOR SIMPLEX SOLUTION)
9806.15234

VALUE OF GAME (IN ORIGINAL UNIT)
-193.84766

BLUE

RED

INDEX OF BLUE-STRATEGY VARIABLES	WEIGHT FOR BLUE STRATEGY	INDEX OF RED-STRATEGY VARIABLES	WEIGHT FOR RED STRATEGY
1	.0000	1	.0756
2	.0000	2	.0593
3	.0000	3	.0476
4	.0000	4	.0700
5	.0000	5	.0518
6	.0000	6	.0434
7	.0000	7	.0643
8	.0000	8	.0446
9	.0000	9	.0403
10	-.0000	10	.0349
11	-.0000	11	.0245
12	.0000	12	.0359
13	.0000	13	.0458
14	.0000	14	.0295
15	.0000	15	.0342

16	.0000	16	.0359
17	.0000	17	.0261
18	.0000	18	.0334
19	-.0000	19	.0392
20	.0000	20	.0552
21	.0000	21	.0304
22	.9993	22	.0001
23	.0000	23	.0000
24	.0000	24	.0273
25	.0000	25	.0078
26	.0000	26	.0078
27	.0000	27	.0350

COMMON NKBD,NKRD,NKBA,NKRA
COMMON NID
COMMON NIBP,NIRP,IBPH(4),IRPH(4)
COMMON NIAB,NIAR
COMMON IPR1,IPR2
COMMON IREPL
COMMON BDA(3,90),RDA(3,90)
COMMON BAA(4,90),RAA(4,90)
COMMON BSHEL,RSHEL
COMMON FBD(3),FRD(3),FBA(4),FRA(4)
COMMON BDKRA,BAKRD
COMMON RDKBA,RAKBD
COMMON BR21A,BR21B,BR23A,BR23B
COMMON RB21A,RB21B,RB23A,RB23B
COMMON NFRFA,FRFA(15),FA(15)
COMMON NFRBD,FRBD(15),BD(15)
COMMON NFRRD,FRRD(15),RD(15)
COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
COMMON MOE(9),IDMOE(9),GVA(9)
COMMON BDI(3,90),RDI(3,90)
COMMON BDD(3,90),RDD(3,90)
COMMON BGF(90),RGF(90)
COMMON BAI(4,90),RAI(4,90)
COMMON BAD(4,90),RAD(4,90)
COMMON BAF(90),RAF(90)
COMMON BF(90),RF(90)
COMMON FEBA(90)
COMMON CBF(90),CRF(90)
COMMON CBAF(90),CRAF(90)
COMMON A1(50,50),A2(50,50),A3(50,50)
COMMON A4(50,50),A5(50,50),A6(50,50)
COMMON A7(50,50),A8(50,50),A9(50,50)
COMMON MS,NS
COMMON AS(50,100),BS(50),CS(100),VLP
COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
COMMON BTS(50),ATSI(50),ATSJ(100)
COMMON VLPT,V,VALUE
COMMON JY(50),YP(50),Y(50)

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COMMON XP(100),X(100)
COMMON IG
OPEN(1,FILE="SADATA",BLANK="ZERO",MAXRECL=80,PAD="YES")
OPEN(3,FILE="SAOUTPUT",CARRIAGECONTROL="FORTRAN")
CALL READ
CALL CAM
CALL GAMES
9999 CONTINUE
END
SUBROUTINE READ
COMMON NKBD,NKRD,NKBA,NKRA
COMMON NID
COMMON NIBP,NIRP,IBPH(4),IRPH(4)
COMMON NIAB,NIAR
COMMON IPR1,IPR2
COMMON IREPL
COMMON BDA(3,90),RDA(3,90)
COMMON BAA(4,90),RAA(4,90)
COMMON BSHEL,RSHEL
COMMON FBD(3),FRD(3),FBA(4),FRA(4)
COMMON BDKRA,BAKRD
COMMON RDKBA,RAKBD
COMMON BR21A,BR21B,BR23A,BR23B
COMMON RB21A,RB21B,RB23A,RB23B
COMMON NFRFA,FRFA(15),FA(15)
COMMON NFRBD,FRBD(15),BD(15)
COMMON NFRRD,FRRD(15),RD(15)
COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
COMMON MOE(9),IDMOE(9),GVA(9)
COMMON BDI(3,90),RDI(3,90)
COMMON BDD(3,90),RDD(3,90)
COMMON BGF(90),RGF(90)
COMMON BAI(4,90),RAI(4,90)
COMMON BAD(4,90),RAD(4,90)
COMMON BAF(90),RAF(90)
COMMON BF(90),RF(90)
COMMON FEBA(90)
COMMON CBF(90),CRF(90)
COMMON CRAF(90),CRAF(90)
COMMON A1(50,50),A2(50,50),A3(50,50)
COMMON A4(50,50),A5(50,50),A6(50,50)
COMMON A7(50,50),A8(50,50),A9(50,50)
COMMON MS,NS
COMMON AS(50,100),BS(50),CS(100),VLF
COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
COMMON BTS(50),ATSI(50),ATSJ(100)
COMMON VLPT,V,VALUE
COMMON JY(50),YP(50),Y(50)
COMMON XP(100),X(100)
10 FORMAT(8I10)
20 FORMAT(8F10.0)

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21 FORMAT(8F10.1)
22 FORMAT(8F10.2)
23 FORMAT(8F10.3)
1010 FORMAT(21H1 NKBD,NKRD,NKBA,NKRA)
1020 FORMAT(5H0 NID)
1030 FORMAT(27H0 NIBF,NIRP,IBPH(I),IRPH(I))
1040 FORMAT(11H0 NIAB,NIAR)
1060 FORMAT(11H0 IPR1,IPR2)
1070 FORMAT( 7H0 IREPL)
2010 FORMAT(13H1 BDA(KBD, ID))
2020 FORMAT(13H0 RDA(KRD, ID))
2030 FORMAT(13H0 BAA(KBA, ID))
2040 FORMAT(13H0 RAA(KRA, ID))
2050 FORMAT( 7H0 BSHEL)
2060 FORMAT( 7H0 RSHEL)
3010 FORMAT(10H1 FBD(KBD))
3020 FORMAT(10H0 FRD(KRD))
3030 FORMAT(10H0 FBA(KBA))
3040 FORMAT(10H0 FRA(KRA))
3201 FORMAT(13H0 BDKRA,BAKRD)
3202 FORMAT(13H0 RDKBA,RAKBD)
3210 FORMAT(25H0 BR21A,BR21B,BR23A,BR23B)
3220 FORMAT(25H0 RB21A,RB21B,RB23A,RB23B)
3410 FORMAT(21H0 NFRFA,FRFA(I),FA(I))
3420 FORMAT(21H0 NFRBD,FRBD(I),BD(I))
3430 FORMAT(21H0 NFRRD,FRRD(I),RD(I))
4010 FORMAT(15H1 PBA1(IAE,IBP))
4020 FORMAT(15H0 PBA2(IAB,IBP))
4025 FORMAT(15H0 PBA3(IAB,IBP))
4030 FORMAT(15H0 PRA1(IAR,IRP))
4040 FORMAT(15H0 PRA2(IAR,IRP))
4045 FORMAT(15H0 PRA3(IAR,IRP))
5010 FORMAT(8H0 MOE(I))
5020 FORMAT(10H0 IDMOE(I))
5030 FORMAT(8H0 GVA(I))
MIT=1
MOT=3
WRITE(MOT,1010)
READ(MIT,10) NKBD,NKRD,NKBA,NKRA
WRITE(MOT,10) NKBD,NKRD,NKBA,NKRA
WRITE(MOT,1020)
READ(MIT,10) NID
WRITE(MOT,10)NID
WRITE(MOT,1030)
READ(MIT,10) NIBF,NIRP,(IBPH(I),I=1,NIBP),
                    (IRPH(I),I=1,NIRP)
WRITE(MOT,10) NIBF,NIRP,(IBPH(I),I=1,NIBP),
                    (IRPH(I),I=1,NIRP)

WRITE(MOT,1040)
READ(MIT,10) NIAB,NIAR
WRITE(MOT,10) NIAB,NIAR
WRITE(MOT,1060)

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READ(MIT,10) IPR1,IPR2
WRITE(MOT,10) IPR1,IPR2
WRITE(MOT,1070)
READ(MIT,10) IREPL
WRITE(MOT,10) IREPL
C
FORCES
WRITE(MOT,2010)
DO 210 KBD=1,NKBD
READ(MIT,20) (BDA(KBD,ID),ID=1,NID)
210 WRITE(MOT,20) (BDA(KBD,ID),ID=1,NID)
WRITE(MOT,2020)
DO 220 KRD=1,NKRD
READ(MIT,20) (RDA(KRD,ID),ID=1,NID)
220 WRITE(MOT,20) (RDA(KRD,ID),ID=1,NID)
WRITE(MOT,2030)
DO 230 KBA=1,NKBA
READ(MIT,20) (BAA(KBA,ID),ID=1,NID)
230 WRITE(MOT,20) (BAA(KBA,ID),ID=1,NID)
WRITE(MOT,2040)
DO 240 KRA=1,NKRA
READ(MIT,20) (RAA(KRA,ID),ID=1,NID)
240 WRITE(MOT,20) (RAA(KRA,ID),ID=1,NID)
WRITE(MOT,2050)
READ(MIT,20) BSHEL
WRITE(MOT,20) BSHEL
WRITE(MOT,2060)
READ(MIT,20) RSHEL
WRITE(MOT,20) RSHEL
C
PARAMETERS
WRITE(MOT,3010)
READ(MIT,21) (FBD(KBD),KBD=1,NKBD)
WRITE(MOT,21) (FBD(KBD),KBD=1,NKBD)
WRITE(MOT,3020)
READ(MIT,21) (FRD(KRD),KRD=1,NKRD)
WRITE(MOT,21) (FRD(KRD),KRD=1,NKRD)
WRITE(MOT,3030)
READ(MIT,23) (FBA(KBA),KBA=1,NKBA)
WRITE(MOT,23) (FBA(KBA),KBA=1,NKBA)
WRITE(MOT,3040)
READ(MIT,23) (FRA(KRA),KRA=1,NKRA)
WRITE(MOT,23) (FRA(KRA),KRA=1,NKRA)
WRITE(MOT,3201)
READ(MIT,23) BDKRA,BAKRD
WRITE(MOT,23) BDKRA,BAKRD
WRITE(MOT,3202)
READ(MIT,23) RDKBA,RAKBD
WRITE(MOT,23) RDKBA,RAKBD
WRITE(MOT,3210)
READ(MIT,23) BR21A,BR21B,BR23A,BR23B
WRITE(MOT,23) BR21A,BR21B,BR23A,BR23B
WRITE(MOT,3220)
READ(MIT,23) RB21A,RB21B,RB23A,RB23B

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WRITE(MOT,23)  RB21A,RB21B,RB23A,RB23B
WRITE(MOT,3410)
READ (MIT,10)  NFRFA
WRITE(MOT,10)  NFRFA
READ (MIT,22) (FRFA(I),I=1,NFRFA)
WRITE(MOT,22) (FRFA(I),I=1,NFRFA)
READ (MIT,21) (FA(I),I=1,NFRFA)
WRITE(MOT,21) (FA(I),I=1,NFRFA)
WRITE(MOT,3420)
READ (MIT,10)  NFRBD
WRITE(MOT,10)  NFRBD
READ (MIT,22) (FRBD(I),I=1,NFRBD)
WRITE(MOT,22) (FRBD(I),I=1,NFRBD)
READ (MIT,23) (BD(I),I=1,NFRBD)
WRITE(MOT,23) (BD(I),I=1,NFRBD)
WRITE(MOT,3430)
READ (MIT,10)  NFRRD
WRITE(MOT,10)  NFRRD
READ (MIT,22) (FRRD(I),I=1,NFRRD)
WRITE(MOT,22) (FRRD(I),I=1,NFRRD)
READ (MIT,23) (RD(I),I=1,NFRRD)
WRITE(MOT,23) (RD(I),I=1,NFRRD)
C  ASSIGNMENTS
WRITE(MOT,4010)
DO 410 IAB=1,NIAB
READ (MIT,22) (PBA1(IAB,IBF),IBF=1,NIBP)
410 WRITE(MOT,22) (PBA1(IAB,IBF),IBF=1,NIBP)
WRITE(MOT,4020)
DO 420 IAB=1,NIAB
READ (MIT,22) (PBA2(IAB,IBF),IBF=1,NIBP)
420 WRITE(MOT,22) (PBA2(IAB,IBF),IBF=1,NIBP)
WRITE(MOT,4025)
DO 425 IAB=1,NIAB
READ (MIT,22) (PBA3(IAB,IBF),IBF=1,NIBP)
425 WRITE(MOT,22) (PBA3(IAB,IBF),IBF=1,NIBP)
WRITE(MOT,4030)
DO 430 IAR=1,NIAR
READ (MIT,22) (PRA1(IAR,IRP),IRP=1,NIRP)
430 WRITE(MOT,22) (PRA1(IAR,IRP),IRP=1,NIRP)
WRITE(MOT,4040)
DO 440 IAR=1,NIAR
READ (MIT,22) (PRA2(IAR,IRP),IRP=1,NIRP)
440 WRITE(MOT,22) (PRA2(IAR,IRP),IRP=1,NIRP)
WRITE(MOT,4045)
DO 445 IAR=1,NIAR
READ (MIT,22) (PRA3(IAR,IRP),IRP=1,NIRP)
445 WRITE(MOT,22) (PRA3(IAR,IRP),IRP=1,NIRP)
C  MEASURES OF EFFECTIVENESS
WRITE(MOT,5010)
READ (MIT,10) (MOE(I),I=1,9)
WRITE(MOT,10) (MOE(I),I=1,9)
WRITE(MOT,5020)

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      READ (MIT,10) (IDMOE(I),I=1,9)
      WRITE(MOT,10) (IDMOE(I),I=1,9)
C     INCREMENT FOR SOLUTION-GAME VALUE ADDITION
      WRITE(MOT,5030)
      READ (MIT,20) (GVA(I),I=1,9)
      WRITE(MOT,20) (GVA(I),I=1,9)
9999  CONTINUE
      RETURN
      END
C     CAM
      SUBROUTINE CAM
      COMMON NKBD,NKRD,NKBA,NKRA
      COMMON NID
      COMMON NIBP,NIRP,IBPH(4),IRPH(4)
      COMMON NIAB,NIAR
      COMMON IPR1,IPR2
      COMMON IREPL
      COMMON BDA(3,90),RDA(3,90)
      COMMON BAA(4,90),RAA(4,90)
      COMMON BSHEL,RSHEL
      COMMON FRD(3),FRD(3),FBA(4),FRA(4)
      COMMON BDKRA,BAKRD
      COMMON RDKBA,RAKBD
      COMMON BR21A,BR21B,BR23A,BR23B
      COMMON RB21A,RB21B,RB23A,RB23B
      COMMON NFRFA,FRFA(15),FA(15)
      COMMON NFRBD,FRBD(15),BD(15)
      COMMON NFRRD,FRRD(15),RD(15)
      COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
      COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
      COMMON MOE(9),IDMOE(9),GVA(9)
      COMMON BDI(3,90),RDI(3,90)
      COMMON BDD(3,90),RDD(3,90)
      COMMON BGF(90),RGF(90)
      COMMON BAI(4,90),RAI(4,90)
      COMMON BAD(4,90),RAD(4,90)
      COMMON BAF(90),RAF(90)
      COMMON BF(90),RF(90)
      COMMON FEBA(90)
      COMMON CBF(90),CRF(90)
      COMMON CBAF(90),CRAF(90)
      COMMON A1(50,50),A2(50,50),A3(50,50)
      COMMON A4(50,50),A5(50,50),A6(50,50)
      COMMON A7(50,50),A8(50,50),A9(50,50)
      COMMON MS,NS
      COMMON AS(50,100),BS(50),CS(100),VLP
      COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
      COMMON BTS(50),ATSI(50),ATSJ(100)
      COMMON VLPT,V,VALUE
      COMMON JY(50),YP(50),Y(50)
      COMMON XP(100),X(100)
      DO 5000 IAB=1,NIAB

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DO 5000 IAR=1,NIAR
DO 3000 ID=1,NID
C   STARTING DIVISION INVENTORY FOR ID  B AND R
IF(ID-1) 1510,1510,1520
1510 DO 1512 KBD=1,NKBD
1512 BDI(KBD, ID)=BDA(KBD, ID)
DO 1514 KRD=1,NKRD
1514 RDI(KRD, ID)=RDA(KRD, ID)
GO TO 1600
1520 IDM1=ID-1
DO 1522 KBD=1,NKBD
1522 BDI(KBD, ID)=BDI(KBD, IDM1)-BDD(KBD, IDM1)+BDA(KBD, ID)
DO 1524 KRD=1,NKRD
C   GROUND FIREPOWER FOR ID  B AND R
1524 RDI(KRD, ID)=RDI(KRD, IDM1)-RDD(KRD, IDM1)+RDA(KRD, ID)
1600 BGF(ID)=0.
DO 1610 KBD=1,NKBD
1610 BGF(ID)=BDI(KBD, ID)*FBD(KBD)
RGF(ID)=0.
DO 1620 KRD=1,NKRD
C   STARTING AIRCRAFT INVENTORY FOR ID  B A D R
1620 RGF(ID)=RDI(KRD, ID)*FRD(KRD)
IF(ID-1) 2010,2010,2020
2010 DO 2012 KBA=1,NKBA
2012 BAI(KBA, ID)=BAA(KBA, ID)
DO 2014 KRA=1,NKRA
2014 RAI(KRA, ID)=RAA(KRA, ID)
GO TO 2100
2020 IDM1=ID-1
DO 2022 KBA=1,NKBA
2022 BAI(KBA, ID)=BAI(KBA, IDM1)-BAD(KBA, IDM1)+BAA(KBA, ID)
DO 2024 KRA=1,NKRA
C   AIRCRAFT ASSIGNMENTS FOR ID  B AND R
2024 RAI(KRA, ID)=RAI(KRA, IDM1)-RAD(KRA, IDM1)+RAA(KRA, ID)
2100 IF(ID-IBPH(1)) 2110,2110,2101
2101 IF(ID-IBPH(2)) 2120,2120,2102
2102 IF(ID-IBPH(3)) 2130,2130,2140
2110 IBP=1
GO TO 2200
2120 IBP=2
GO TO 2200
2130 IBP=3
GO TO 2200
2140 IBP=4
GO TO 2200
2200 BA11=FBA1(IAB, IBP)*BAI(1, ID)
BA12=BAI(2, ID)
BA21=FBA2(IAB, IBP)*BAI(1, ID)
BA23=BAI(3, ID)
BA31=FBA3(IAB, IBP)*BAI(1, ID)
BA34=BAI(4, ID)
BA1=BA11+BA12

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    BA2=BA21+BA23
    BA3=BA31+BA34
    IF(ID-IRPH(1)) 2310,2310,2301
2301 IF(ID-IRPH(2)) 2320,2320,2302
2302 IF(ID-IRPH(3)) 2330,2330,2340
2310 IRP=1
    GO TO 2400
2320 IRP=2
    GO TO 2400
2330 IRP=3
    GO TO 2400
2340 IRP=4
    GO TO 2400
2400 RA11=PRA1(IAR,IRP)*RAI(1,ID)
    RA12=RAI(2,ID)
    RA21=PRA2(IAR,IRP)*RAI(1,ID)
    RA23=RAI(3,ID)
    RA31=PRA3(IAR,IRP)*RAI(1,ID)
    RA34=RAI(4,ID)
    RA1=RA11+RA12
    RA2=RA21+RA23
    RA3=RA31+RA34
C   AIRCRAFT DESTRUCTION AIR TO AIR AND REVISED ATTACK
    BAT=BA1+BA2
    RDT=RA3
    IF(BAT-0.) 2402,2402,2405
2402 BATK=0.
    RDTK=0.
    FBATK=0.
    FRDTK=0.
    GO TO 2411
2405 IF(RDT-0.) 2407,2407,2410
2407 BATK=0.
    RDTK=0.
    FBATK=0.
    FRDTK=0.
    GO TO 2411
2410 BATK=BAT*(1,-EXP(-RDKBA*(RDT/BAT)))
    RDTK=RDT*(1,-EXP(-BAKRD*(BAT/RDT)))
    FBATK=BATK/BAT
    FRDTK=RDTK/RDT
2411 RAT=RA1+RA2
    BDT=BA3
    IF(RAT-0.) 2412,2412,2415
2412 RATK=0.
    BDTK=0.
    FRATK=0.
    FBDTK=0.
    GO TO 2430
2415 IF(BDT-0.) 2417,2417,2420
2417 RATK=0.

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EDTK=0.
FRATK=0.
FBDTK=0.
GO TO 2430
2420 RATK=RAT*(1.-EXP(-BDKRA*(BDT/RAT)))
BDTK=BDT*(1.-EXP(-RAKBD*(RAT/BDT)))
FRATK=RATK/RAT
FBDTK=BDTK/BDT
2430 BA11K=BA11*FBATK
BA12K=BA12*FBATK
BA21K=BA21*FBATK
BA23K=BA23*FBATK
RD31K=RA31*FRDTK
RD34K=RA34*FRDTK
RA11K=RA11*FRATK
RA12K=RA12*FRATK
RA21K=RA21*FRATK
RA23K=RA23*FRATK
BD31K=BA31*FBDTK
BD34K=BA34*FBDTK
BA11 =BA11-BA11K
BA12 =BA12-BA12K
BA21 =BA21-BA21K
BA23 =BA23-BA23K
RA11 =RA11-RA11K
RA12 =RA12-RA12K
RA21 =RA21-RA21K
RA23 =RA23-RA23K
C AIRCRAFT DESTRUCTION AIRBASE ATTACK
2500 BAIT=0.
DO 2510 KBA=1,NKBA
2510 BAIT=BAIT+BAI(KBA,ID)
BAIT=BAIT-(BA11K+BA12K+BA21K+BA23K+BD31K+BD34K)
IF(BAIT-BSHEL) 2515,2515,2520
2515 BAITNS=BAIT
BAITNS=0.
GO TO 2530
2520 BAITNS=BSHEL
BAITNS=BAIT-BAITNS
2530 IF(BAIT=0.) 25301,25301,25302
25301 BAK=0.
GO TO 2550
25302 IF(BAITNS=0.) 25311,25311,25312
25311 BAK=0.
GO TO 2550
25312 RA21S=RA21*(BAITNS/BAIT)
RA21NS=RA21-RA21S
RA23S=RA23*(BAITNS/BAIT)
RA23NS=RA23-RA23S
RAITS=RA21S+RA23S
RAITNS=RA21NS+RA23NS
IF(RAITS=0.) 2532,2532,2534

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2532 BAK=0.
      GO TO 2550
2534 TERM=(RB21A*RA21S+RB23A*RA23S)/RAITS
      BAKS=BAITS*(1.-EXP(-TERM*(RAITS/BAITS)))
      IF(RAITNS-0.) 2535,2535,2540
2535 BAK=BAKS
      GO TO 2550
2540 TERM=(RB21B*RA21NS+RB23B*RA23NS)/RAITNS
      BAKNS=BAITNS*(1.-EXP(-TERM*(RAITNS/BAITNS)))
      BAK=BAKS+BAKNS
2550 CONTINUE
      RAIT=0.
      DO 2560 KRA=1,NKRA
2560 RAIT=RAIT+RAI(KRA,ID)
      RAIT=RAIT-(RA11K+RA12K+RA21K+RA23K+RD31K+RD34K)
      IF(RAIT-RSHEL) 2565,2565,2570
2565 RAIT=RAIT
      RAITNS=0.
      GO TO 2580
2570 RAIT=RSHEL
      RAITNS=RAIT-RAITS
2580 IF(RAIT-0.) 25801,25801,25802
25801 RAK=0.
      GO TO 2600
25802 IF(RAITS-0.) 25811,25811,25812
25811 RAK=0.
      GO TO 2600
25812 BA21S=BA21*(RAITS/RAIT)
      BA21NS=BA21-BA21S
      BA23S=BA23*(RAITS/RAIT)
      BA23NS=BA23-BA23S
      BAITNS=BA21NS+BA23NS
      IF(BAITNS-0.) 2582,2582,2584
2582 RAK=0.
      GO TO 2600
2584 TERM=(BR21A*BA21S+BR23A*BA23S)/BAITS
      RAKS=BAITS*(1.-EXP(-TERM*(BAITS/BAITS)))
      IF(RAITNS-0.) 2585,2585,2590
2585 RAK=RAKS
      GO TO 2600
2590 TERM=(BR21B*BA21NS+BR23B*BA23NS)/BAITNS
      RAKNS=BAITNS*(1.-EXP(-TERM*(BAITNS/BAITNS)))
      RAK=RAKS+RAKNS
2600 CONTINUE
C     TOTAL AIRCRAFT DESTRUCTION
      DO 2603 KBA=1,NKBA
2601 BAD(KBA,ID)=0.
      GO TO 26020
2602 BAD(KBA,ID)=BAK*(BAI(KBA,ID)/BAIT)
26020 IF(KBA-2) 26021,26022,26025

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26021 BAD(KBA, ID)=BAD(KBA, ID)+BA11K+BA21K+BD31K
      GO TO 2603
26022 BAD(KBA, ID)=BAD(KBA, ID)+BA12K
      GO TO 2603
26025 IF(KBA-4) 26026,26027,26027
26026 BAD(KBA, ID)=BAD(KBA, ID)+BA23K
      GO TO 2603
26027 BAD(KBA, ID)=BAD(KBA, ID)+BD34K
      2603 CONTINUE
          DO 2606 KRA=1, NKRA
          IF(RAK-0.) 2604,2604,2605
      2604 RAD(KRA, ID)=0.
          GO TO 26050
      2605 RAD(KRA, ID)=RAK*(RAI(KRA, ID)/RAIT)
26050 IF(KRA-2) 26051,26052,26055
26051 RAD(KRA, ID)=RAD(KRA, ID)+RA11K+RA21K+RD31K
      GO TO 2606
26052 RAD(KRA, ID)=RAD(KRA, ID)+RA12K
      GO TO 2606
26055 IF(KRA-4) 26056,26057,26057
26056 RAD(KRA, ID)=RAD(KRA, ID)+RA23K
      GO TO 2606
26057 RAD(KRA, ID)=RAD(KRA, ID)+RD34K
      2606 CONTINUE
C      AIR FIREPOWER FOR ID      B AND R
      IF(BA12-0.) 26071,26071,26072
26071 BAF(ID)=BA11*FBA(1)
      GO TO 2608
26072 BAF(ID)=BA11*FBA(1)+BA12*FBA(2)
      2608 IF(RA12-0.) 26081,26081,26082
26081 RAF(ID)=RA11*FRA(1)
      GO TO 2609
26082 RAF(ID)=RA11*FRA(1)+RA12*FRA(2)
      2609 CONTINUE
C      TOTAL FIREPOWER FOR ID      B AND R
      BF(ID)=BGF(ID)+BAF(ID)
      RF(ID)=RGF(ID)+RAF(ID)
C      FEBA FOR ID
      FRBR=BF(ID)/RF(ID)
      CALL CVFX(NFRFA, FRFA, FA, FRBR, DFEB)
      IF(ID-1) 2610,2610,2620
      2610 FEBA(ID)=DFEBA
          GO TO 2700
      2620 IDM1=ID-1
          FEBA(ID)=FEBA(IDM1)+DFEBA
C      DIVISION DESTRUCTION FOR ID
      IF(IREPL-0) 2660,2660,2650
      2650 DO 2652 KBD=1, NKBD
      2652 BDD(KBD, ID)=0.
          DO 2654 KRD=1, NKRD
      2654 RDD(KRD, ID)=0.

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GO TO 2700
2660 CALL CVFX(NFRBD,FRBD,BD,FRBR,PRDID)
DO 2662 KBD=1,NKBD
2662 BDD(KBD,ID)=BDI(KBD,ID)*PRDID
CALL CVFX(NFRRD,FRRD,RD,FRBR,PRDID)
DO 2664 KRD=1,NKRD
C CUMULATIVE TOTAL AND AIR FIREPOWER B AND R
2664 RDD(KRD,ID)=RDI(KRD,ID)*PRDID
2700 IF(ID-1) 2710,2710,2720
2710 CBF(ID)=BF(ID)
CRF(ID)=RF(ID)
CBAF(ID)=BAF(ID)
CRAF(ID)=RAF(ID)
GO TO 2800
2720 IDM1=ID-1
CBF(ID)=CBF(IDM1)+BF(ID)
CRF(ID)=CRF(IDM1)+RF(ID)
CBAF(ID)=CBAF(IDM1)+BAF(ID)
CRAF(ID)=CRAF(IDM1)+RAF(ID)
C CALL PR1 IF IPR1=1
2800 IF(IPR1-1) 3000,2900,2900
2900 CALL PR1
C END OF DO LOOP ON ID
3000 CONTINUE
C PLACE VALUES OF MOES IN ARRAYS
IF(MOE(1)-1) 3190,3100,3100
3100 IDT=IDMOE(1)
A1(IAB,IAR)=FEBA(IDT)
3190 IF(MOE(2)-1) 3290,3200,3200
3200 IDT=IDMOE(2)
A2(IAB,IAR)=FEBA(IDT)
3290 IF(MOE(3)-1) 3390,3300,3300
3300 IDT=IDMOE(3)
A3(IAB,IAR)=FEBA(IDT)
3390 IF(MOE(4)-1) 3490,3400,3400
3400 IDT=IDMOE(4)
A4(IAB,IAR)=CBF(IDT)-CRF(IDT)
3490 IF(MOE(5)-1) 3590,3500,3500
3500 IDT=IDMOE(5)
A5(IAB,IAR)=CBF(IDT)-CRF(IDT)
3590 IF(MOE(6)-1) 3690,3600,3600
3600 IDT=IDMOE(6)
A6(IAB,IAR)=CBF(IDT)-CRF(IDT)
3690 IF(MOE(7)-1) 3790,3700,3700
3700 IDT=IDMOE(7)
A7(IAB,IAR)=CBAF(IDT)-CRAF(IDT)
3790 IF(MOE(8)-1) 3890,3800,3800
3800 IDT=IDMOE(8)
A8(IAB,IAR)=CBAF(IDT)-CRAF(IDT)
3890 IF(MOE(9)-1) 3990,3900,3900
3900 IDT=IDMOE(9)
A9(IAB,IAR)=CBAF(IDT)-CRAF(IDT)

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3990 CONTINUE
C   END OF DO LOOP ON IAB, IAR
5000 CONTINUE
C   CALL PR2 IF IPR2=1
      IF(IPR2-1)7000,6000,6000
6000 CALL PR2
7000 CONTINUE
9999 CONTINUE
      RETURN
      END
      SUBROUTINE GAMES
      COMMON NKBD, NKRD, NKBA, NKRA
      COMMON NID
      COMMON NIBP, NIRP, IBPH(4), IRPH(4)
      COMMON NIAB, NIAR
      COMMON IPR1, IPR2
      COMMON IREPL
      COMMON EDA(3,90), RDA(3,90)
      COMMON BAA(4,90), RAA(4,90)
      COMMON BSHEL, RSHEL
      COMMON FBD(3), FRD(3), FBA(4), FRA(4)
      COMMON BDKRA, BAKRD
      COMMON RDKBA, RAKBD
      COMMON BR21A, BR21B, BR23A, BR23B
      COMMON RB21A, RB21B, RB23A, RB23B
      COMMON NFRFA, FRFA(15), FA(15)
      COMMON NFRBD, FRBD(15), BD(15)
      COMMON NFRRD, FRRD(15), RD(15)
      COMMON PBA1(50,4), PBA2(50,4), PBA3(50,4)
      COMMON PRA1(50,4), PRA2(50,4), PRA3(50,4)
      COMMON MOE(9), IDMOE(9), GVA(9)
      COMMON BDI(3,90), RDI(3,90)
      COMMON BDD(3,90), RDD(3,90)
      COMMON RGF(90), RGF(90)
      COMMON BAI(4,90), RAI(4,90)
      COMMON BAD(4,90), RAD(4,90)
      COMMON BAF(90), RAF(90)
      COMMON BF(90), RF(90)
      COMMON FEBA(90)
      COMMON CBF(90), CRF(90)
      COMMON CBAF(90), CRAF(90)
      COMMON A1(50,50), A2(50,50), A3(50,50)
      COMMON A4(50,50), A5(50,50), A6(50,50)
      COMMON A7(50,50), A8(50,50), A9(50,50)
      COMMON MS, NS
      COMMON AS(50,100), BS(50), CS(100), VLF, PUL
      COMMON IPATHS(50), CTS(50), ZS(100), ZMCS(100)
      COMMON BTS(50), ATSI(50), ATSJ(100)
      COMMON VLPT, V, VALUE, VA
      COMMON JY(50), YP(50), Y(50)
      COMMON XP(100), X(100)
      COMMON IG

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C      DO LOOP ON GAMES
      DO 3000 IG=1,9
C      SET AS,BS,CS=0
      NIART=NIAR+NIAB
      DO 510 IAB=1,NIAB
      DO 510 IAR=1,NIART
510    AS(IAB,IAR)=0.
      DO 520 IAB=1,NIAB
520    BS(IAB)=0.
      DO 530 IAR=1,NIART
C      CHOOSE GAME AND FILL IN AS(IAB,IAR)
530    CS(IAR)=0.
      IF(MOE(IG)-1) 3000,1002,3000
1002  IF(IG-2) 1010,1020,1004
1004  IF(IG-4) 1030,1040,1006
1006  IF(IG-6) 1050,1060,1008
1008  IF(IG-8) 1070,1080,1090
1010  DO 1015 IAB=1,NIAB
      DO 1015 IAR=1,NIAR
1015  AS(IAB,IAR)=A1(IAB,IAR)+GVA(1)
      GO TO 1200
1020  DO 1025 IAB=1,NIAB
      DO 1025 IAR=1,NIAR
1025  AS(IAB,IAR)=A2(IAB,IAR)+GVA(2)
      GO TO 1200
1030  DO 1035 IAB=1,NIAB
      DO 1035 IAR=1,NIAR
1035  AS(IAB,IAR)=A3(IAB,IAR)+GVA(3)
      GO TO 1200
1040  DO 1045 IAB=1,NIAB
      DO 1045 IAR=1,NIAR
1045  AS(IAB,IAR)=A4(IAB,IAR)+GVA(4)
      GO TO 1200
1050  DO 1055 IAB=1,NIAB
      DO 1055 IAR=1,NIAR
1055  AS(IAB,IAR)=A5(IAB,IAR)+GVA(5)
      GO TO 1200
1060  DO 1065 IAB=1,NIAB
      DO 1065 IAR=1,NIAR
1065  AS(IAB,IAR)=A6(IAB,IAR)+GVA(6)
      GO TO 1200
1070  DO 1075 IAB=1,NIAB
      DO 1075 IAR=1,NIAR
1075  AS(IAB,IAR)=A7(IAB,IAR)+GVA(7)
      GO TO 1200
1080  DO 1085 IAB=1,NIAB
      DO 1085 IAR=1,NIAR
1085  AS(IAB,IAR)=A8(IAB,IAR)+GVA(8)
      GO TO 1200
1090  DO 1095 IAB=1,NIAB
      DO 1095 IAR=1,NIAR
1095  AS(IAB,IAR)=A9(IAB,IAR)+GVA(9)

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```

        GO TO 1200
C      CS(J)=1
1200   DO 1210 IAR=1,NIAB
C      BS(I)=1
1210   CS(IAR)=-1.
        DO 1220 IAB=1,NIAB
C      AS(I,J)=IDENTITY FOR (1,NIAR+1) TO (NIAB,NIAR+NIAB)
1220   BS(IAB)=1.
        DO 1310 IAB=1,NIAB
        IAR=NIAR+IAB
1310   AS(IAB,IAR)=1.
C      MS,NS
        MS=NIAB
        NS=NIART
C      CALL SIMPLEX
        CALL SIMPX
C      VALUE OF GAME
        V=1./(-VLP)
        VALUE=V-GVA(IG)
        VA=1./PVL
C      OPTIMAL RED STRATEGY
        DO 1510 I=1,MS
        JY(I)=I
1510   YP(I)=BS(I)
        DO 1520 I=1,MS
C      OPTIMAL BLUE STRATEGY
1520   Y(I)=VA*YP(I)
        DO 1530 J=1,NS
1530   XP(J)=-ZMCS(J)
        DO 1540 J=1,NS
1540   X(J)=V*XP(J)
        CALL PGAME
3000   CONTINUE
9999   CONTINUE
        RETURN
        END
        SUBROUTINE CVFX(M,X,FX,VX,VFX)
        DIMENSION X(8),FX(8)
        I=1
        IF(VX-X(1)) 30,20,10
10     DO 12 I=2,M
        IF(VX-X(I)) 15,20,12
12     CONTINUE
        XDIF=VX-X(M)
        FRAC=XDIF/(X(M)-X(M-1))
        VFX=FX(M)+FRAC*(FX(M)-FX(M-1))
        GO TO 99
15     XDIF=VX-X(I-1)
        FRAC=XDIF/(X(I)-X(I-1))
        VFX=FX(I-1)+FRAC*(FX(I)-FX(I-1))
        GO TO 99
20     VFX=FX(I)

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      GO TO 99
30  XDIF=X(1)-VX
      FRAC=XDIF/(X(2)-X(1))
      VFX=FX(1)-FRAC*(FX(2)-FX(1))
      GO TO 99
99  CONTINUE
      RETURN
      END
      SUBROUTINE PR1
      COMMON NKBD,NKRD,NKBA,NKRA
      COMMON NID
      COMMON NIBP,NIRP,IBPH(4),IRPH(4)
      COMMON NIAB,NIAR
      COMMON IPR1,IPR2
      COMMON IREPL
      COMMON BDA(3,90),RDA(3,90)
      COMMON BAA(4,90),RAA(4,90)
      COMMON BSHEL,RSHEL
      COMMON FBD(3),FRD(3),FBA(4),FRA(4)
      COMMON BDKRA,BAKRD
      COMMON RDKBA,RAKBD
      COMMON BR21A,BR21B,BR23A,BR23B
      COMMON RB21A,RB21B,RB23A,RB23B
      COMMON NFRFA,FRFA(15),FA(15)
      COMMON NFRBD,FRBD(15),BD(15)
      COMMON NFRRD,FRRD(15),RD(15)
      COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
      COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
      COMMON MOE(9),IDMOE(9),GVA(9)
      COMMON BDI(3,90),RDI(3,90)
      COMMON BDD(3,90),RDD(3,90)
      COMMON BGF(90),RGF(90)
      COMMON BAI(4,90),RAI(4,90)
      COMMON BAD(4,90),RAD(4,90)
      COMMON BAF(90),RAF(90)
      COMMON BF(90),RF(90)
      COMMON FEBA(90)
      COMMON CBF(90),CRF(90)
      COMMON CBAF(90),CRAF(90)
      COMMON A1(50,50),A2(50,50),A3(50,50)
      COMMON A4(50,50),A5(50,50),A6(50,50)
      COMMON A7(50,50),A8(50,50),A9(50,50)
      COMMON MS,NS
      COMMON AS(50,100),BS(50),CS(100),VLF
      COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
      COMMON BTS(50),ATSI(50),ATSJ(100)
      COMMON VLPT,V,VALUE
      COMMON JY(50),YP(50),Y(50)
      COMMON XP(100),X(100)
20  FORMAT(8F10.0)
105 FORMAT(9H1 IAB, IAR)
110 FORMAT(9H0 BGF(ID))

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120 FORMAT(9H0 RGF(ID))
130 FORMAT(13H0 BAI(KBA, ID))
140 FORMAT(13H0 RAI(KRA, ID))
210 FORMAT(9H0 BAF(ID))
220 FORMAT(9H0 RAF(ID))
230 FORMAT(8H0 BF(ID))
240 FORMAT(8H0 RF(ID))
310 FORMAT(10H0 FEBA(ID))
320 FORMAT(9H0 CBF(ID))
330 FORMAT(9H0 CRF(ID))
340 FORMAT(10H0 CBAF(ID))
350 FORMAT(10H0 CRAF(ID))
MOT=3
WRITE(MOT,105)
WRITE(MOT,110)
WRITE(MOT,20) (RGF(ID), ID=1, NID)
WRITE(MOT,120)
WRITE(MOT,20) (RGF(ID), ID=1, NID)
WRITE(MOT,130)
DO 1130 KBA=1, NKBA
1130 WRITE(MOT,20) (BAI(KBA, ID), ID=1, NID)
WRITE(MOT,140)
DO 1140 KRA=1, NKRA
1140 WRITE(MOT,20) (RAI(KRA, ID), ID=1, NID)
WRITE(MOT,210)
WRITE(MOT,20) (BAF(ID), ID=1, NID)
WRITE(MOT,220)
WRITE(MOT,20) (RAF(ID), ID=1, NID)
WRITE(MOT,230)
WRITE(MOT,20) (BF(ID), ID=1, NID)
WRITE(MOT,240)
WRITE(MOT,20) (RF(ID), ID=1, NID)
WRITE(MOT,310)
WRITE(MOT,20) (FEBA(ID), ID=1, NID)
WRITE(MOT,320)
WRITE(MOT,20) (CBF(ID), ID=1, NID)
WRITE(MOT,330)
WRITE(MOT,20) (CRF(ID), ID=1, NID)
WRITE(MOT,340)
WRITE(MOT,20) (CBAF(ID), ID=1, NID)
WRITE(MOT,350)
WRITE(MOT,20) (CRAF(ID), ID=1, NID)
9999 CONTINUE
RETURN
END
SUBROUTINE PR2
COMMON NKBD, NKRD, NKBA, NKRA
COMMON NID
COMMON NIBP, NIRP, IBPH(4), IRPH(4)
COMMON NIAB, NIAR
COMMON IPR1, IPR2
COMMON IREPL

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COMMON BDA(3,90),RDA(3,90)
COMMON BAA(4,90),RAA(4,90)
COMMON BSHEL,RSHEL
COMMON FBD(3),FRD(3),FBA(4),FRA(4)
COMMON BDKRA,BAKRD
COMMON RDKBA,RAKBD
COMMON BR21A,BR21B,BR23A,BR23B
COMMON RB21A,RB21B,RB23A,RB23B
COMMON NFRFA,FRFA(15),FA(15)
COMMON NFRBD,FRBD(15),BD(15)
COMMON NFRRD,FRRD(15),RD(15)
COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
COMMON MOE(9),IDMOE(9),GVA(9)
COMMON BDI(3,90),RDI(3,90)
COMMON BDD(3,90),RDD(3,90)
COMMON BGF(90),RGF(90)
COMMON BAI(4,90),RAI(4,90)
COMMON BAD(4,90),RAD(4,90)
COMMON BAF(90),RAF(90)
COMMON BF(90),RF(90)
COMMON FEBA(90)
COMMON CBF(90),CRF(90)
COMMON CBAF(90),CRAF(90)
COMMON A1(50,50),A2(50,50),A3(50,50)
COMMON A4(50,50),A5(50,50),A6(50,50)
COMMON A7(50,50),A8(50,50),A9(50,50)
COMMON MS,NS
COMMON AS(50,100),BS(50),CS(100),VLP
COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
COMMON BTS(50),ATSI(50),ATSIJ(100)
COMMON VLPT,V,VALUE
COMMON JY(50),YF(50),Y(50)
COMMON XP(100),X(100)
50 FORMAT(1H0)
100 FORMAT(8E15.5)
110 FORMAT(13H1 A1(IAB,IAR))
120 FORMAT(13H1 A2(IAB,IAR))
130 FORMAT(13H1 A3(IAB,IAR))
140 FORMAT(13H1 A4(IAB,IAR))
150 FORMAT(13H1 A5(IAB,IAR))
160 FORMAT(13H1 A6(IAB,IAR))
170 FORMAT(13H1 A7(IAB,IAR))
180 FORMAT(13H1 A8(IAB,IAR))
190 FORMAT(13H1 A9(IAB,IAR))
200 FORMAT(1H0,20X,2I5,E15.5)
210 FORMAT(1H0,40X,2I5,E15.5)
MOT=3
WRITE(MOT,110)
DO 1010 IAB=1,NIAB
WRITE(MOT,50)
DO 1015 IAR=1,NIAR

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WRITE(MOT,100) A1(IAB,IAR)
AA=99999.
IF(A1(IAB,IAR).LE.AA) GO TO 10
GO TO 1015
10 AA=A1(IAB,IAR)
J=IAR
1015 CONTINUE
WRITE(MOT,200) IAB,J,AA
BB=-99999.
IF(AA.GE.BB) GO TO 20
GO TO 1010
20 BB=AA
I=IAB
1010 CONTINUE
WRITE(MOT,210) I,J,BB
WRITE(MOT,120)
DO 1020 IAB=1,NIAB
1020 WRITE(MOT,100) (A2(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,130)
DO 1030 IAB=1,NIAB
1030 WRITE(MOT,100) (A3(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,140)
DO 1040 IAB=1,NIAB
1040 WRITE(MOT,100) (A4(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,150)
DO 1050 IAB=1,NIAB
1050 WRITE(MOT,100) (A5(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,160)
DO 1060 IAB=1,NIAB
1060 WRITE(MOT,100) (A6(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,170)
DO 1070 IAB=1,NIAB
1070 WRITE(MOT,100) (A7(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,180)
DO 1080 IAB=1,NIAB
1080 WRITE(MOT,100) (A8(IAB,IAR),IAR=1,NIAR)
WRITE(MOT,190)
DO 1090 IAB=1,NIAB
1090 WRITE(MOT,100) (A9(IAB,IAR),IAR=1,NIAR)
9999 CONTINUE
RETURN
END
SUBROUTINE SIMPX
COMMON NKED,NKRD,NKBA,NKRA
COMMON NID
COMMON NIBP,NIRP,IBPH(4),IRPH(4)
COMMON NIAB,NIAR
COMMON IPR1,IPR2
COMMON IREPL
COMMON BDA(3,90),RDA(3,90)
COMMON BAA(4,90),RAA(4,90)
COMMON BSHEL,RSHEL

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COMMON FBI(3),FRD(3),FBA(4),FRA(4)
COMMON BDKRA,BAKRD
COMMON RDKBA,RAKRD
COMMON BR21A,BR21B,BR23A,BR23B
COMMON RB21A,RB21B,RB23A,RB23B
COMMON NFRFA,FRFA(15),FA(15)
COMMON NFRBD,FRBD(15),BD(15)
COMMON NFRRD,FRRD(15),RD(15)
COMMON FBA1(50,4),FBA2(50,4),FBA3(50,4)
COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
COMMON MOE(9),IIMOE(9),GVA(9)
COMMON BDI(3,90),RDI(3,90)
COMMON BDD(3,90),RDD(3,90)
COMMON BGF(90),RGF(90)
COMMON BAI(4,90),RAI(4,90)
COMMON BAD(4,90),RAD(4,90)
COMMON BAF(90),RAF(90)
COMMON BF(90),RF(90)
COMMON FEBA(90)
COMMON CBF(90),CRF(90)
COMMON CBAF(90),CRAF(90)
COMMON A1(50,50),A2(50,50),A3(50,50)
COMMON A4(50,50),A5(50,50),A6(50,50)
COMMON A7(50,50),A8(50,50),A9(50,50)
COMMON MS,NS
COMMON AS(50,100),BS(50),CS(100),VLP,FVL
COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
COMMON BTS(50),ATSI(50),ATSJ(100)
COMMON VLPT,V,VALUE,VA
COMMON JY(50),YP(50),Y(50)
COMMON XP(100),X(100)
C   SET IPATHS EQUAL BASIS,CTS EQUAL BAIS COSTS
DO 18150 I=1,MS
J=NS-MS+I
IPATHS(I)=J
18150 CTS(I)=CS(J)
C   BEGIN ITERATION
18200 COST=0.
SUBS=0
DO 18205 I=1,MS
C   COMPUTE ZS AND ZMCS VECTORS
SUBS=SUBS+BS(I)
18205 COST=COST+CTS(I)*BS(I)
18216 DO 18220 J=1,NS
ZTS=0.
DO 18217 I=1,MS
18217 ZTS=ZTS+CTS(I)*AS(I,J)
ZS(J)=ZTS
18220 ZMCS(J)=ZS(J)-CS(J)
C   SELECT MAXIMUM ZMCS,IF NO POSITIVE END.
CMAX=ZMCS(1)
JMAX=1

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      DO 18250 J=2,NS
      IF(CMAX-ZMCS(J)) 18240,18250,18250
18240 CMAX=ZMCS(J)
      JMAX=J
18250 CONTINUE
      IF(ZMCS(JMAX)-.1E-6) 20000,20000,18260
C      SELECT MINIMUM DS(I)=BS(I)/AS(I,JMAX) WHERE
      A(I,JMAX) IS POSITIVE
18260 DSMIN=1.E+35
      DO 18350 I=1,MS
      IF(AS(I,JMAX)-.1E-6) 18350,18350,18300
18300 DST=BS(I)/AS(I,JMAX)
      IF(DST-DSMIN) 18310,18350,18350
18310 DSMIN=DST
      IMIN=I
18350 CONTINUE
C      COMPUTE NEW MATRIX ATS
      DO 18400 I=1,MS
      BTS(I)=AS(I,JMAX)*BS(IMIN)/AS(IMIN,JMAX)
18400 ATSI(I)=AS(I,JMAX)/AS(IMIN,JMAX)
      TEMP=AS(IMIN,JMAX)
      DO 18410 J=1,NS
18410 ATSJ(J)=AS(IMIN,J)
      DO 18525 I=1,MS
      IF(I-IMIN) 18450,18500,18450
18450 IF(ATSI(I)) 18455,18525,18455
18455 BS(I)=BS(I)-BTS(I)
      DO 18475 J=1,NS
      IF(ATSJ(J)) 18460,18475,18460
18460 AS(I,J)=AS(I,J)-ATSI(I)*ATSJ(J)
18475 CONTINUE
      GO TO 18525
18500 DO 18510 J=1,NS
18510 AS(I,J)=AS(I,J)/TEMP
      BS(I)=BS(I)/TEMP
18525 CONTINUE
C      SUBSTITUTE IPATH OF JMAX FOR IMIN.C OF JMAX FOR IMIN
      IPATHS(IMIN)=JMAX
      CTS(IMIN)=CS(JMAX)
C      TRANSFER BACK TO BEGIN ITERATION
      GO TO 18200
C      SET VLP=COST
20000 VLP=COST
      PVL=SUBS
      MOT=3
      WRITE(MOT,500)
      DO 10 I=1,MS
      WRITE(MOT,100) I,BS(I)
10 CONTINUE
      WRITE(MOT,400)
      DO 20 J=1,NS
      WRITE(MOT,200) J,ZMCS(J)

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20 CONTINUE
  WRITE(MOT,300) VLF,PVL
100 FORMAT(10X,I3,F15.8)
200 FORMAT(10X,I3,F15.8)
300 FORMAT(/,10X,2F20.5)
500 FORMAT(1H1)
400 FORMAT(/)
9999 CONTINUE
  RETURN
  END
  SUBROUTINE PGAME
  COMMON NKBD,NKRD,NKBA,NKRA
  COMMON NID
  COMMON NIBP,NIRP,IBPH(4),IRPH(4)
  COMMON NIAB,NIAR
  COMMON IPR1,IPR2
  COMMON IREPL
  COMMON BDA(3,90),RDA(3,90)
  COMMON BAA(4,90),RAA(4,90)
  COMMON BSHEL,RSHEL
  COMMON FRD(3),FRD(3),FBA(4),FRA(4)
  COMMON BDKRA,BAKRD
  COMMON RDKBA,RAKBD
  COMMON BR21A,BR21B,BR23A,BR23B
  COMMON RB21A,RB21B,RB23A,RB23B
  COMMON NFRFA,FRFA(15),FA(15)
  COMMON NFRBD,FRBD(15),BD(15)
  COMMON NFRRD,FRRD(15),RD(15)
  COMMON PBA1(50,4),PBA2(50,4),PBA3(50,4)
  COMMON PRA1(50,4),PRA2(50,4),PRA3(50,4)
  COMMON MOE(9),IDMOE(9),GVA(9)
  COMMON BDI(3,90),RDI(3,90)
  COMMON BDD(3,90),RDD(3,90)
  COMMON RGF(90),RGF(90)
  COMMON BAI(4,90),RAI(4,90)
  COMMON RAD(4,90),RAD(4,90)
  COMMON BAF(90),RAF(90)
  COMMON BF(90),RF(90)
  COMMON FEBA(90)
  COMMON CBF(90),CRF(90)
  COMMON CBAF(90),CRAF(90)
  COMMON A1(50,50),A2(50,50),A3(50,50)
  COMMON A4(50,50),A5(50,50),A6(50,50)
  COMMON A7(50,50),A8(50,50),A9(50,50)
  COMMON MS,NS
  COMMON AS(50,100),BS(50),CS(100),VLF,PVL
  COMMON IPATHS(50),CTS(50),ZS(100),ZMCS(100)
  COMMON BTS(50),ATSI(50),ATSI(100)
  COMMON VLPT,V,VALUE,VA
  COMMON JY(50),YP(50),Y(50)
  COMMON XP(100),X(100)
  COMMON IG

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    DIMENSION INT(50)
    30 FORMAT(8F15.5)
    50 FORMAT(I18,F21.4,26X,I9,15X,F15.4)
    110 FORMAT(1H0,"VALUE OF GAME ( INCLUDING GAME VALUE",
      * " ADDED FOR SIMPLEX SOLUTION )")
    115 FORMAT(1H , "VALUE OF GAME ( IN ORIGINAL UNIT )")
    120 FORMAT(1H0,"BLUE",53X,"RED",/)
    130 FORMAT(/11X,"INDEX OF BLUE-", 7X,"WEIGHT FOR",26X,
      * "INDEX OF RED-",16X,"WEIGHT FOR",/,9X,"STRATEGY
      VARIABLES",
      * 4X,"BLUE STRATEGY",22X,"STRATEGY VARIABLES",12X,
      * "RED STRATEGY")
    100 FORMAT(1H1,"MOE : POSITION OF THE FEBA AT THE END
      OF SUB-PERIOD 10")
    200 FORMAT(1H1,"MOE : POSITION OF THE FEBA AT THE END
      OF SUB-PERIOD 30")
    300 FORMAT(1H1,"MOE : POSITION OF THE FEBA AT THE END
      OF SUB-PERIOD 90")
    400 FORMAT(1H1,"MOE : CUMULATIVE TOTAL FIREPOWER BY
      SUB-PERIOD 10")
    500 FORMAT(1H1,"MOE : CUMULATIVE TOTAL FIREPOWER BY
      SUB-PERIOD 30")
    600 FORMAT(1H1,"MOE : CUMULATIVE TOTAL FIREPOWER BY
      SUB-PERIOD 90")
    700 FORMAT(1H1,"MOE : CUMULATIVE AIR FIREPOWER BY
      SUB-PERIOD 10")
    800 FORMAT(1H1,"MOE : CUMULATIVE AIR FIREPOWER BY
      SUB-PERIOD 30")
    900 FORMAT(1H1,"MOE : CUMULATIVE AIR FIREPOWER BY
      SUB-PERIOD 90")
    MOT=3
    GO TO (1,2,3,4,5,6,7,8,9),IG
    1 WRITE(MOT,100)
    GO TO 150
    2 WRITE(MOT,200)
    GO TO 150
    3 WRITE(MOT,300)
    GO TO 150
    4 WRITE(MOT,400)
    GO TO 150
    5 WRITE(MOT,500)
    GO TO 150
    6 WRITE(MOT,600)
    GO TO 150
    7 WRITE(MOT,700)
    GO TO 150
    8 WRITE(MOT,800)
    GO TO 150
    9 WRITE(MOT,900)
    150 WRITE(MOT,110)
    WRITE(MOT,30) V

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```
WRITE(MOT,115)
WRITE(MOT,30) VALUE
WRITE(MOT,120)
WRITE(MOT,130)
DO 1010 K=1,MS
1010 INT(K)=K
DO 1020 K=1,MS
J=MS+K
WRITE(MOT,50) INT(K),X(J),JY(K),Y(K)
1020 CONTINUE
9999 CONTINUE
RETURN
END
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