

Some commentary:

The implementation of the Pearson's Chi-Squared Test for Independence is correct.

The Fair-weather mode basically never gets entered. I think it was intended to see if a usually-cooperative opponent would defect in response to a defect. However, the indexing works that the opponent would have to defect (not in response to a defect) but at the same time unprovoked. This mode is only entered if the opponent Cooperates 36 times and defects on the 37th turn, in response to yet another Cooperation.

There are a couple of places that seem like they're not indexed the way they were intended:

- My "burned" flag is "IBURN" in Harrington's code, so I think that it's meant to signal a Defection in response to an unusual cooperation, but it works out that sometimes it marks a burn as a Defection in response to a Defection. I think it intends to look for a response to the Cooperation that's scheduled to follow.
- The history matrix is based off of this strategy's moves two turns ago but not last turn. I originally had previous turn in there instead, and it detected random much better.

By far the thing that makes this the most different from Tit-for-Tat (aside from Defect mode) is the parity flags. It's hard to tell what motives this logic, though.

Code Notes:

```
FUNCTION K75R(J,M,K,L,R,JA)
```

```
C BY P D HARRINGTON
```

```
C TYPED BY JM 3/20/79
```

```
DIMENSION HIST(4,2),ROW(4),COL(2),ID(2)
```

```
K75R=JA ! Added 7/32/93 to report own old value
```

```
IF (M .EQ. 2) GOTO 25
```

This causes the history to not be updated until the third round.

```
IF (M .GT. 1) GOTO 10
```

```
DO 5 IA = 1,4
```

```
DO 5 IB = 1,2
```

```
5 HIST(IA,IB) = 0
```

```
IBURN = 0
```

```
ID(1) = 0
```

```
ID(2) = 0
```

```
IDEF = 0
```

```
ITWIN = 0
```

```
ISTRNG = 0
```

```
ICOOP = 0
```

```
ITRY = 0
```

```
IRDCHK = 0
```

```
IRAND = 0
```

```
IPARTY = 1
```

```
IND = 0
MY = 0
INDEF = 5
IOPP = 0
PROB = .2
```

I set this equal to 0.25 because line 69 gets run trivially on turn 37.

```
K75R = 0
```

```
RETURN
```

```
10 IF (IRAND .EQ. 1) GOTO 70
```

This sends to Defect mode.

```
IOPP = IOPP + J
```

```
HIST(IND,J+1) = HIST(IND,J+1) + 1
```

IND is set at the end of last turn, unless we were in or entering Defect mode.

```
IF (M .EQ. 15 .OR. MOD(M,15) .NE. 0 .OR. IRAND .EQ. 2) GOTO 25
```

IRAND = 2 means that we were in Defect mode, but escaped

```
IF (HIST(1,1) / (M - 2) .GE. .8) GOTO 25
```

GOTO 25 for the next few lines means Random Not Detected.

```
IF (IOPP * 4 .LT. M - 2 .OR. IOPP * 4 .GT. 3 * M - 6) GOTO 25
```

```
DO 12 IA = 1,4
```

```
12 ROW(IA) = HIST(IA,1) + HIST(IA,2)
```

```
DO 14 IB = 1,2
```

```
SUM = .0
```

```
DO 13 IA = 1,4
```

```
13 SUM = SUM + HIST(IA,IB)
```

```
14 COL(IB) = SUM
```

```
SUM = .0
```

```
DO 16 IA = 1,4
```

```
DO 16 IB = 1,2
```

```
EX = ROW(IA) * COL(IB) / (M - 2)
```

This is Pearson's Chi Squared.

```
IF (EX .LE. 1.) GOTO 16
```

```
SUM = SUM + ((HIST(IA,IB) - EX) ** 2) / EX
```

```
16 CONTINUE
```

```
IF (SUM .GT. 3) GOTO 25
```

```
IRAND = 1
```

Enter Defect mode

```
K75R = 1
```

Defect Immediately

```
RETURN
```

```
25 IF (ITRY .EQ. 1 .AND. J .EQ. 1) IBURN = 1
```

When ITRY is set, it is set to 2, it isn't decremented until

we cooperate again, so this means the flag was set two turns ago. I used a clearer variable.

```
IF (M .LE. 37 .AND. J .EQ. 0) ITWIN = ITWIN + 1
```

This line isn't run until M=2, so we can only collect ITWIN=36 from this line.

```
IF (M .EQ. 38 .AND. J .EQ. 1) ITWIN = ITWIN + 1
```

Here is where we get the 37th ITWIN iff the opponent's 37th move was a Defection. Note that we defect on the 37th, so this gives no time to respond. Actually, a response often is taken as a burn.

```
IF (M .GE. 39 .AND. ITWIN .EQ. 37 .AND. J .EQ. 1) ITWIN = 0
```

This is the criteria to exit Fair-Weather, and continue with Normal mode, starting at Line 58.

```
IF (ITWIN .EQ. 37) GOTO 80
```

Fair-weather mode. Go straight to Cooperate.

```
IDEF = IDEF * J + J
```

Increment or reset. This is the defect streak counter.

```
IF (IDEF .GE. 20) GOTO 90
```

Line 90 is your standard Defection

```
IPARTY = 3 - IPARTY
```

Flip the Parity Bit

```
ID(IPARTY) = ID(IPARTY) * J + J
```

Increment or Reset

```
IF (ID(IPARTY) .GE. INDEF) GOTO 78
```

Check if it exceed the limit.

```
IF (ICOOP .GE. 1) GOTO 80
```

This says that more Cooperations are scheduled. If so, then Cooperate, and lower the counter.

```
IF (M .LT. 37 .OR. IBURN .EQ. 1) GOTO 34
```

Line 34 is basically Tit-for-Tat.

```
IF (M .EQ. 37) GOTO 32
```

```
IF (R .GT. PROB) GOTO 34
```

```
32 ITRY = 2
```

This marks the upcoming move as what I call "generous"

```
ICOOP = 2
```

Schedule the next TWO turns as Cooperations

```
PROB = PROB + .05
```

```
GOTO 92
```

```
34 IF (J .EQ. 0) GOTO 80
```

```
GOTO 90
```

```
70 IRDCHK = IRDCHK + J * 4 - 3
```

This is the exit Defect mode logic.

```
IF (IRDCHK .GE. 11) GOTO 75
```

Upon exiting, schedule two Cooperations. Don't mark as generous.

K75R = 1

Otherwise, Defect.

RETURN

75 IRAND = 2

ICOOP = 2

K75R = 0

RETURN

78 ID(IPARTY) = 0

If parity streak is found, then reset these streaks.

ISTRNG = ISTRNG + 1

IF (ISTRNG .EQ. 8) INDEF = 3

After eight streaks, lower the criteria.

80 K75R = 0

ITRY = ITRY - 1

ICOOP = ICOOP - 1

Decrement these flags

GOTO 95

90 ID(IPARTY) = ID(IPARTY) + 1

This usually causes a second increment of the parity streak variables. I'm not sure why this is done.

92 K75R = 1

95 IND = 2 * MY + J + 1

This is where the history index gets updated. It gets run unless, in Defect mode or Entering Defect mode. Entering Defect mode still records history, so the index from the turn before entering Defect mode will get counted a second time if Defect mode is exited. (The turn after.)

MY = K75R

RETURN

END