Algorithm

Our method was tested with the help of Algorithm 50 in *The Computer Journal* (Bell, 1970) and we describe here only the additions to it.

Appendix 1

Added just before the line '**goto** *w*1*continue*;'

```
for i := locate[2] step 1 until blackpiece[0] do
blackpiece[i] := blackpiece[i + 1];
blackpiece[blackpiece[0]] := backto[2];
```

Appendix 2

(excludes the usage of Appendix 1)
Declarations at the beginning of program:

```
integer b1help, b1opt;
integer array b1first[0:49];
```

In the procedure makemove, after the line starting with '*a*6:' is added:

```
if depth = 1 then
begin
for j := 0 step 5 until b1opt - 1 do
for i := 0 step 1 until 4 do
moves[i + b1help + j] := b1first[i + b1opt - 5 - j];
to := b1help;
numberofmoves[1] := b1help + b1opt;
end else to := numberofmoves[depth];
```

'*to* :=' is removed from the line next to the one starting with '*ep*3:'.

Near the end of a program, just before the line '**goto** *w*1*continue*;' is added:

```
for i := 1 step 5 until b1opt do
if q[2] = b1first[i] and moves[b1 + 1] = b1first[i + 2] then
begin
if i + 4 = b1opt then goto by;
for j := i - 1 step 1 until b1opt - 6
  do b1first[j] := b1first[j + 5];
b1opt := b1opt - 5; goto out;
end;
out:
b1first[b1opt] := locate[2];
b1first[b1opt + 1] := q[2];
b1first[b1opt + 2] := backto[2];
b1first[b1opt + 3] := moves[b1 + 1];
b1first[b1opt + 4] := -backto[2];
b1opt := b1opt + 5;
by:
```

In the lines:

```
for w1 := 3 step 1 until numberofmoves[1] do
for b1 := numberofmoves[1] + 2 step 1 until
numberofmoves[2] do
```

'*numberofmoves*[1]' is replaced by '*b*1*help*'.

Appendix 3

In procedure Makemove is added, just after the line 'start:'

```
if moves[pointer + 1] = 0 then
begin from := moves[pointer]; pointer := pointer + 1;
  goto next end;
if depth = 2andpointer < numberofmoves[1]
  andmoves[pointer + 2] < 0 then
begin
for i := numberofmoves[2] - 1 step -1
  until numberofmoves[1] + 4 do
begin
if moves[i] ≥ 0 then goto nexti;
if moves[i] = moves[pointer + 2] then
begin
for k := i - 1, k - 1 while moves [k] > 0 do
if moves[k] = moves[pointer + 1] then
begin moves[k] := 0; goto fin end;
goto om;
end;
nexti: end;
om: pointer := pointer + 5;
locate[2] := moves[pointer - 2];
q[2] := moves[pointer - 1];
backto[2] := moves[pointer];
goto start;
fin: end check of list;
```

'*next*:' is added just before the line '*to* := *moves*[*pointer* + 1];'

Appendix 4

A minor improvement based on the fact that the Queen cannot be a masking piece in a battery.

Added after the line '*n* := *numberofmoves*[4];':

```
if q[3] = 5 then
begin
integer array acc[0:1];
acc[0] := 1; acc[1] := whitepiece[locate[3]];
listmoves(acc, whitemen, blackmen, n, notstalemate);
end else
```

Appendix 5

The line after the declaration of procedure Reversemove:
c[1] := 0;
is replaced by:

```
for i := 1 step 1 until 5 do c[i] := 0;
```

References

Bell, A. G. (1970). Algorithm 50: How to program a computer to play legal chess, *The Computer Journal*, Vol. 13, pp. 208-219.

Manning, J. R. (1971). Algorithm 68: White to move and mate in *n* moves, *The Computer Journal*, Vol. 14, pp. 209-213.

Nilsson, N. J. (1971). *Problem-Solving Methods in Artificial Intelligence*, New York: McGraw-Hill.

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Samuel, A. L. (1967). Some Studies in Machine Learning, Part II, *IBM Journal*, Vol. 11, pp. 601-627.

Erratum

There is an error in the paper 'An Information Measure for Hierarchic Classification' by D. M. Boulton and C. S. Wallace (this *Journal*, Vol. 16, No. 3, pp. 254-261). The error is on page 261, in the second paragraph after Figure 1. The second sentence 'The two classes (4, 6) and (1, 2, 3, 5, 7)—' should read 'The two classes (2, 7) and (1, 3, 4, 5, 6)—'.

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