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> # CRUDE BISECTION ALGORITHM
> bisection:=proc(TOL) local I,C,P; global A, B, F, ANS;
> A:=evalf(A); B:=evalf(B);
> if (A=B) then print('A cannot equal B. '); RETURN(); fi;
> if (F(A)*F(B)>=0) then print('F(A) and F(B) have the same sign. ');
> RETURN(); fi;
> I:=1; ANS:=array(1..7, ['i', 'a', 'f(a)', 'b', 'f(b)', 'p',
  'f(p)']);
> while (abs(B-A)/2)>(TOL/2) do
>   P:=(A+B)/2; C:=array(1..7, [I, A, evalf(F(A)), B, evalf(F(B)),
  P, evalf(F(P))]);
>   ANS := linalg[stack](ANS, C);
>   I:= I+1;
>   if C[3]*C[7]<0 then B:=P else A:=P;
> fi;od;
> RETURN(op(ANS));
> end;

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*bisection* := **proc**(TOL)

**local** I, C, P;

**global** A, B, F, ANS;

A := evalf(A);

B := evalf(B);

**if** A = B **then** print( 'A cannot equal B. '); RETURN( ) **fi**;

**if** 0 ≤ F(A)\*F(B) **then** print( 'F(A) and F(B) have the same sign. '); RETURN( ) **fi**;

I := 1;

ANS := array(1 .. 7, [i, a, f(a), b, f(b), p, f(p)]);

**while** 1 / 2\*TOL < 1 / 2\*abs(B - A) **do**

    P := 1 / 2\*A + 1 / 2\*B;

    C := array(1 .. 7, [I, A, evalf(F(A)), B, evalf(F(B)), P, evalf(F(P))]);

    ANS := linalg[stack](ANS, C);

    I := I + 1;

**if** C[3]\*C[7] < 0 **then** B := P **else** A := P **fi**

**od**;

RETURN(op(ANS))

**end**

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> F:= u^3 - 7*u^2 +14*u -6: F:=unapply(F,u);

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$$F := u \rightarrow u^3 - 7u^2 + 14u - 6$$

We do problem 3, page 53.

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> A:=0.0; B:= 1.; bisection(.01);

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A := 0

B := 1.

<i>i</i>	<i>a</i>	<i>f(a)</i>	<i>b</i>	<i>f(b)</i>	<i>p</i>	<i>f(p)</i>
1	0	-6.	1.	2.	.5000000000	-.6250000000
2	.5000000000	-.6250000000	1.	2.	.7500000000	.9843750000
3	.5000000000	-.6250000000	.7500000000	.9843750000	.6250000000	.259765625
4	.5000000000	-.6250000000	.6250000000	.259765625	.5625000000	-.161865234
5	.5625000000	-.161865234	.6250000000	.259765625	.5937500000	.054046630
6	.5625000000	-.161865234	.5937500000	.054046630	.5781250000	-.052623748
7	.5781250000	-.052623748	.5937500000	.054046630	.5859375000	.001031399

> A:= 1.0: B:= 3.2: bisection(.01);

<i>i</i>	<i>a</i>	<i>f(a)</i>	<i>b</i>	<i>f(b)</i>	<i>p</i>	<i>f(p)</i>
1	1.0	2.000	3.2	-.112	2.100000000	1.79100000
2	2.100000000	1.79100000	3.2	-.112	2.650000000	.55212500
3	2.650000000	.55212500	3.2	-.112	2.925000000	.08582813
4	2.925000000	.08582813	3.2	-.112	3.062500000	-.05444336
5	2.925000000	.08582813	3.062500000	-.05444336	2.993750000	.00632788
6	2.993750000	.00632788	3.062500000	-.05444336	3.028125000	-.02652072
7	2.993750000	.00632788	3.028125000	-.02652072	3.010937500	-.01069693
8	2.993750000	.00632788	3.010937500	-.01069693	3.002343750	-.00233275

> A:= 3.2: B:= 4: bisection(.01);

<i>i</i>	<i>a</i>	<i>f(a)</i>	<i>b</i>	<i>f(b)</i>	<i>p</i>	<i>f(p)</i>
1	3.2	-.112	4.	2.	3.600000000	.33600000
2	3.2	-.112	3.600000000	.33600000	3.400000000	-.01600000
3	3.400000000	-.01600000	3.600000000	.33600000	3.500000000	.12500000
4	3.400000000	-.01600000	3.500000000	.12500000	3.450000000	.04612500
5	3.400000000	-.01600000	3.450000000	.04612500	3.425000000	.01301563
6	3.400000000	-.01600000	3.425000000	.01301563	3.412500000	-.00199805
7	3.412500000	-.00199805	3.425000000	.01301563	3.418750000	.00538161

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> F:= u^2-3; F:=unapply(F,u);

$$F := u^2 - 3$$

$$F := u \rightarrow u^2 - 3$$

> A:=1: B:=2: bisection(.0001);

$i$	$a$	$f(a)$	$b$	$f(b)$	$p$	$f(p)$
1	1.	-2.	2.	1.	1.500000000	-.750000000
2	1.500000000	-.750000000	2.	1.	1.750000000	.062500000
3	1.500000000	-.750000000	1.750000000	.062500000	1.625000000	-.359375000
4	1.625000000	-.359375000	1.750000000	.062500000	1.687500000	-.152343750
5	1.687500000	-.152343750	1.750000000	.062500000	1.718750000	-.045898437
6	1.718750000	-.045898437	1.750000000	.062500000	1.734375000	.008056641
7	1.718750000	-.045898437	1.734375000	.008056641	1.726562500	-.018981934
8	1.726562500	-.018981934	1.734375000	.008056641	1.730468750	-.005477905
9	1.730468750	-.005477905	1.734375000	.008056641	1.732421875	.001285553
10	1.730468750	-.005477905	1.732421875	.001285553	1.731445313	-.002097128
11	1.731445313	-.002097128	1.732421875	.001285553	1.731933594	-.000406026
12	1.731933594	-.000406026	1.732421875	.001285553	1.732177735	.000439706
13	1.731933594	-.000406026	1.732177735	.000439706	1.732055665	.000016827
14	1.731933594	-.000406026	1.732055665	.000016827	1.731994630	-.000194602

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