

# Results of calculations for numbers in IEEE 754 standard and NPAAt format

**Comparative results of summing signed decimal numbers according to the standard IEEE 754 algorithm and summation in NPAAt format.**

The terminal screenshots show the output data obtained using the demonstration algorithm `npap-algorithm.cpp`

1. Sum of  $x_1 = -0.89382715639$  with 999999 additions of  $x_2 = 0.7878271567$

```
Microsoft Visual Studio Debug Console
```

i=	2		NPA	=	-0.10599999968999995747509501597960480		IEEE	=	-0.10599999968999995747509501597960480
i=	3		NPA	=	0.68182715701000007335608188441256061		IEEE	=	0.68182715701000007335608188441256061
i=	4		NPA	=	1.46965431371000021520956124732038006		IEEE	=	1.46965431370999999316495632228907198
i=	5		NPA	=	2.25748147041000013501843568519689143		IEEE	=	2.25748147041000013501843568519689143
i=	6		NPA	=	3.04530862711000027687191504810471088		IEEE	=	3.04530862711000027687191504810471088
i=	7		NPA	=	3.83313578381000041872539441101253033		IEEE	=	3.83313578381000041872539441101253033
i=	8		NPA	=	4.62096294051000011648966392385773361		IEEE	=	4.62096294051000011648966392385773361
i=	9		NPA	=	5.40879009720999981425393343670293689		IEEE	=	5.40879009720999981425393343670293689
i=	10		NPA	=	6.19661725390999951201820294954814017		IEEE	=	6.19661725390999951201820294954814017
i=	100000		NPA	=	78781.03401580645004287362098693847656250		IEEE	=	78781.03401580645004287362098693847656250
i=	200000		NPA	=	157563.74968555770465172827243804931640625		IEEE	=	157563.74968555770465172827243804931640625
i=	300000		NPA	=	236346.46535434309043921530246734619140625		IEEE	=	236346.46535434309043921530246734619140625
i=	400000		NPA	=	315129.18102508585434406995773315429687500		IEEE	=	315129.18102508585434406995773315429687500
i=	500000		NPA	=	393911.89669678162317723035812377929687500		IEEE	=	393911.89669678162317723035812377929687500
i=	600000		NPA	=	472694.61236847739201039075851440429687500		IEEE	=	472694.61236847739201039075851440429687500
i=	700000		NPA	=	551477.32804017316084355115890502929687500		IEEE	=	551477.32804017316084355115890502929687500
i=	800000		NPA	=	630260.04371186892967671155929565429687500		IEEE	=	630260.04371186892967671155929565429687500
i=	900000		NPA	=	709042.75938356469850987195968627929687500		IEEE	=	709042.75938356469850987195968627929687500
i=	1000000		NPA	=	787825.47505526046734303236007690429687500		IEEE	=	787825.47505526046734303236007690429687500

2. Sum of  $x_1 = 0.89382715639$  with 999999  
additions of  $x_2 = 0.7878271567$

```
Microsoft Visual Studio Debug Console
+ -
i= 2 | NPAt= 1.68165431309000013015975127927958965 | IEEE= 1.68165431309000013015975127927958965
i= 3 | NPAt= 2.46948146979000027201323064218740910 | IEEE= 2.46948146979000027201323064218740910
i= 4 | NPAt= 3.25730862649000041386671000509522855 | IEEE= 3.25730862649000041386671000509522855
i= 5 | NPAt= 4.04513578319000011163097951794043183 | IEEE= 4.04513578319000011163097951794043183
i= 6 | NPAt= 4.83296293988999980939524903078563511 | IEEE= 4.83296293988999980939524903078563511
i= 7 | NPAt= 5.62079009658999950715951854363083839 | IEEE= 5.62079009658999950715951854363083839
i= 8 | NPAt= 6.40861725328999920492378805647604167 | IEEE= 6.40861725328999920492378805647604167
i= 9 | NPAt= 7.19644440998999890268805756932124496 | IEEE= 7.19644440998999890268805756932124496
i= 10 | NPAt= 7.98427156668999860045232708216644824 | IEEE= 7.98427156668999860045232708216644824
i= 100000 | NPAt= 78782.82167011922865640372037887573242188 | IEEE= 78782.82167011922865640372037887573242188
i= 200000 | NPAt= 157565.53733987043960951268672943115234375 | IEEE= 157565.53733987043960951268672943115234375
i= 300000 | NPAt= 236348.25300865582539699971675872802734375 | IEEE= 236348.25300865582539699971675872802734375
i= 400000 | NPAt= 315130.96867939864750951528549194335937500 | IEEE= 315130.96867939864750951528549194335937500
i= 500000 | NPAt= 393913.68435109441634267568588256835937500 | IEEE= 393913.68435109441634267568588256835937500
i= 600000 | NPAt= 472696.40002279018517583608627319335937500 | IEEE= 472696.40002279018517583608627319335937500
i= 700000 | NPAt= 551479.11569448595400899648666381835937500 | IEEE= 551479.11569448595400899648666381835937500
i= 800000 | NPAt= 630261.83136618172284215688705444335937500 | IEEE= 630261.83136618172284215688705444335937500
i= 900000 | NPAt= 709044.54703787749167531728744506835937500 | IEEE= 709044.54703787749167531728744506835937500
i=1000000 | NPAt= 787827.26270957326050847768783569335937500 | IEEE= 787827.26270957326050847768783569335937500
```

3. Sum of  $x_1 = 89382715639$  with 9999999 additions of  $x_2 = 7878271567$

```
Microsoft Visual Studio Debug Console
+
v

i=      2 | NPAt=      97260987206.0 | IEEE=      97260987206.0
i=      3 | NPAt=     105139258773.0 | IEEE=     105139258773.0
i=      4 | NPAt=     113017530340.0 | IEEE=     113017530340.0
i=      5 | NPAt=     120895801907.0 | IEEE=     120895801907.0
i=      6 | NPAt=     128774073474.0 | IEEE=     128774073474.0
i=      7 | NPAt=     136652345041.0 | IEEE=     136652345041.0
i=      8 | NPAt=     144530616608.0 | IEEE=     144530616608.0
i=      9 | NPAt=     152408888175.0 | IEEE=     152408888175.0
i=     10 | NPAt=     160287159742.0 | IEEE=     160287159742.0
i= 100000 | NPAt=     787908661144072.0 | IEEE=     787908661144072.0
i= 200000 | NPAt=    1575735817844072.0 | IEEE=    1575735817844072.0
i= 300000 | NPAt=    2363562974544072.0 | IEEE=    2363562974544072.0
i= 400000 | NPAt=    3151390131244072.0 | IEEE=    3151390131244072.0
i= 500000 | NPAt=    3939217287944072.0 | IEEE=    3939217287944072.0
i= 600000 | NPAt=    4727044444644072.0 | IEEE=    4727044444644072.0
i= 700000 | NPAt=    5514871601344072.0 | IEEE=    5514871601344072.0
i= 800000 | NPAt=    6302698758044072.0 | IEEE=    6302698758044072.0
i= 900000 | NPAt=    7090525914744072.0 | IEEE=    7090525914744072.0
i=1000000 | NPAt=    7878353071444072.0 | IEEE=    7878353071444072.0
```

4. Sum of  $x_1 = 89382715639e+15$  with  
999999 additions of  $x_2 = 7878271567e+23$

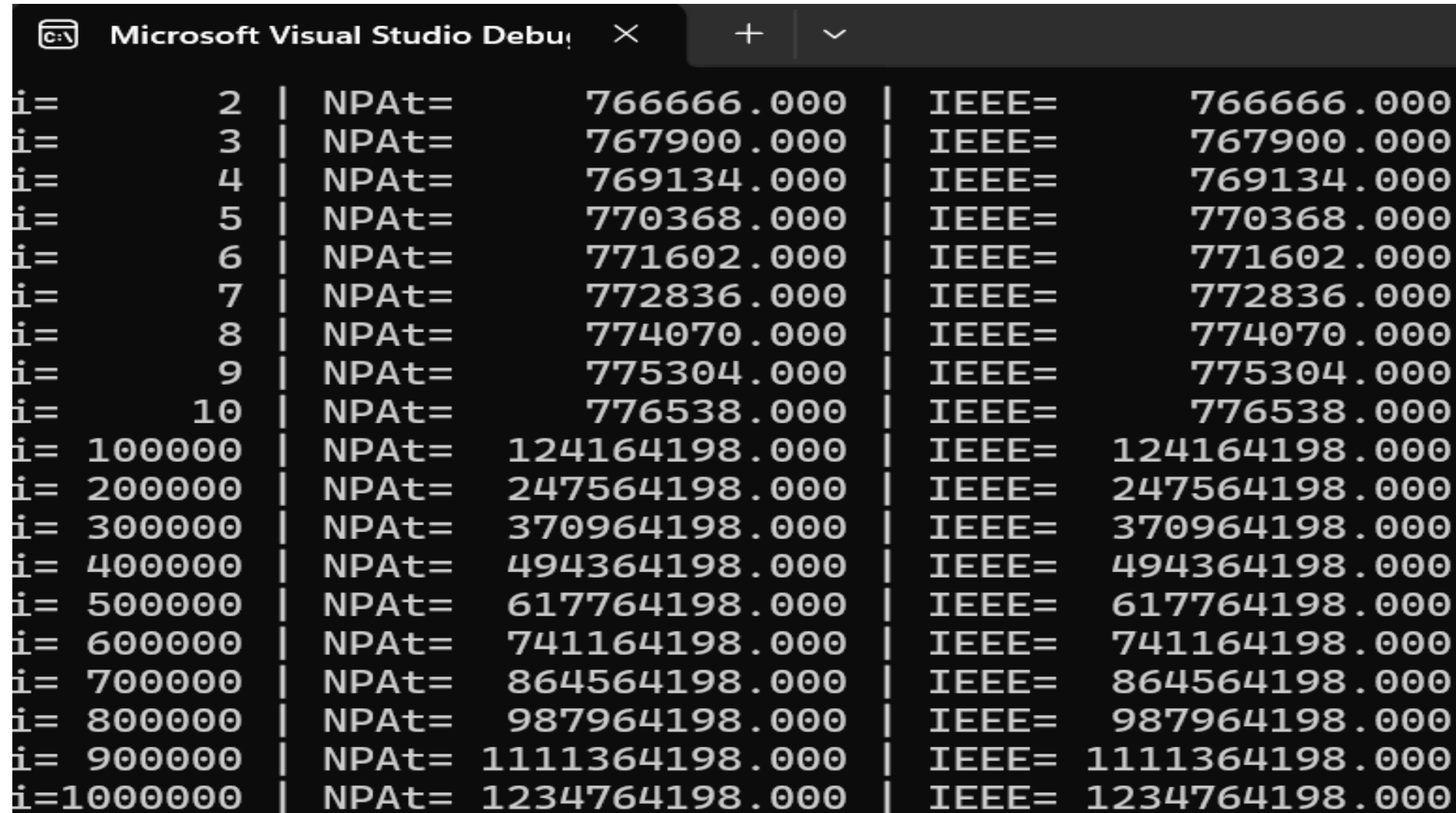
```
Microsoft Visual Studio Debug Console
+ v

i= 2 | NPA=787827246082715723239632899407872.0 | IEEE=787827246082715723239632899407872.0
i= 3 | NPA=787827335465431410931775993544704.0 | IEEE=787827335465431410931775993544704.0
i= 4 | NPA=787827424848147098623919087681536.0 | IEEE=787827424848147098623919087681536.0
i= 5 | NPA=787827514230862786316062181818368.0 | IEEE=787827514230862786316062181818368.0
i= 6 | NPA=787827603613578474008205275955200.0 | IEEE=787827603613578474008205275955200.0
i= 7 | NPA=787827692996294161700348370092032.0 | IEEE=787827692996294161700348370092032.0
i= 8 | NPA=787827782379009849392491464228864.0 | IEEE=787827782379009849392491464228864.0
i= 9 | NPA=787827871761725537084634558365696.0 | IEEE=787827871761725537084634558365696.0
i= 10 | NPA=787827961144441224776777652502528.0 | IEEE=787827961144441224776777652502528.0
i= 100000 | NPA=796765338886053562164760394334208.0 | IEEE=796765338886053562164760394334208.0
i= 200000 | NPA=805703610454822776474174077534208.0 | IEEE=805703610454822776474174077534208.0
i= 300000 | NPA=814641882023591990783587760734208.0 | IEEE=814641882023591990783587760734208.0
i= 400000 | NPA=823580153592361205093001443934208.0 | IEEE=823580153592361205093001443934208.0
i= 500000 | NPA=832518425161130419402415127134208.0 | IEEE=832518425161130419402415127134208.0
i= 600000 | NPA=841456696729899633711828810334208.0 | IEEE=841456696729899633711828810334208.0
i= 700000 | NPA=850394968298668848021242493534208.0 | IEEE=850394968298668848021242493534208.0
i= 800000 | NPA=859333239867438062330656176734208.0 | IEEE=859333239867438062330656176734208.0
i= 900000 | NPA=868271511436207276640069859934208.0 | IEEE=868271511436207276640069859934208.0
```

5. Sum of  $x_1 = 838.678$  with 99999999  
additions of  $x_2 = 7.87827e+76.236$

```
Microsoft Visual Studio Debu | + | v
i= 2 | NPA= 914.91399999999987267074175179005 | IEEE= 914.91399999999987267074175179005
i= 3 | NPA= 991.149999999999977262632455676794 | IEEE= 991.149999999999977262632455676794
i= 4 | NPA= 1067.385999999999967258190736174583 | IEEE= 1067.385999999999967258190736174583
i= 5 | NPA= 1143.622000000000070940586738288403 | IEEE= 1143.622000000000070940586738288403
i= 6 | NPA= 1219.858000000000174622982740402222 | IEEE= 1219.858000000000174622982740402222
i= 7 | NPA= 1296.094000000000278305378742516041 | IEEE= 1296.094000000000278305378742516041
i= 8 | NPA= 1372.330000000000381987774744629860 | IEEE= 1372.330000000000381987774744629860
i= 9 | NPA= 1448.566000000000485670170746743679 | IEEE= 1448.566000000000485670170746743679
i= 10 | NPA= 1524.802000000000589352566748857498 | IEEE= 1524.802000000000589352566748857498
i= 100000 | NPA= 7624362.441982096992433071136474609375 | IEEE= 7624362.441982096992433071136474609375
i= 200000 | NPA= 15247962.441938884556293487548828125000 | IEEE= 15247962.441938884556293487548828125000
i= 300000 | NPA= 22871562.442044571042060852050781250000 | IEEE= 22871562.442044571042060852050781250000
i= 400000 | NPA= 30495162.442187622189521789550781250000 | IEEE= 30495162.442187622189521789550781250000
i= 500000 | NPA= 38118762.442330673336982727050781250000 | IEEE= 38118762.442330673336982727050781250000
i= 600000 | NPA= 45742362.442473724484443664550781250000 | IEEE= 45742362.442473724484443664550781250000
i= 700000 | NPA= 53365962.442616775631904602050781250000 | IEEE= 53365962.442616775631904602050781250000
i= 800000 | NPA= 60989562.442759826779365539550781250000 | IEEE= 60989562.442759826779365539550781250000
i= 900000 | NPA= 68613162.442902877926826477050781250000 | IEEE= 68613162.442902877926826477050781250000
i=1000000 | NPA= 76236762.443045929074287414550781250000 | IEEE= 76236762.443045929074287414550781250000
```

6. Sum of  $x_1 = 1234$  with 999999 additions of  $x_2 = 765432$



The screenshot shows the Microsoft Visual Studio Debugger window with a table of loop iteration data. The table has four columns: the loop counter 'i', the variable 'NPAt', and the IEEE floating-point representation of the sum. The iterations are divided into two sections: the first section shows iterations from i=2 to i=10, and the second section shows iterations from i=100000 to i=1000000. In the first section, the sum increases by 765432 in each step. In the second section, the sum increases by 1234 in each step, reflecting the large number of additions.

i	NPAt	IEEE
2	766666.000	766666.000
3	767900.000	767900.000
4	769134.000	769134.000
5	770368.000	770368.000
6	771602.000	771602.000
7	772836.000	772836.000
8	774070.000	774070.000
9	775304.000	775304.000
10	776538.000	776538.000
100000	124164198.000	124164198.000
200000	247564198.000	247564198.000
300000	370964198.000	370964198.000
400000	494364198.000	494364198.000
500000	617764198.000	617764198.000
600000	741164198.000	741164198.000
700000	864564198.000	864564198.000
800000	987964198.000	987964198.000
900000	1111364198.000	1111364198.000
1000000	1234764198.000	1234764198.000

7. Sum of  $x_1 = -8.93827e+10$  with 99999 additions of  $x_2 = 7.87827e+09$

Microsoft Visual Studio Debug Console					
i=	2	NPA	-8638.000	IEEE	-8638.000
i=	3	NPA	-7404.000	IEEE	-7404.000
i=	4	NPA	-6170.000	IEEE	-6170.000
i=	5	NPA	-4936.000	IEEE	-4936.000
i=	6	NPA	-3702.000	IEEE	-3702.000
i=	7	NPA	-2468.000	IEEE	-2468.000
i=	8	NPA	-1234.000	IEEE	-1234.000
i=	9	NPA	0.000	IEEE	0.000
i=	10	NPA	1234.000	IEEE	1234.000
i=	100000	NPA	123388894.000	IEEE	123388894.000
i=	200000	NPA	246788894.000	IEEE	246788894.000
i=	300000	NPA	370188894.000	IEEE	370188894.000
i=	400000	NPA	493588894.000	IEEE	493588894.000
i=	500000	NPA	616988894.000	IEEE	616988894.000
i=	600000	NPA	740388894.000	IEEE	740388894.000
i=	700000	NPA	863788894.000	IEEE	863788894.000
i=	800000	NPA	987188894.000	IEEE	987188894.000
i=	900000	NPA	1110588894.000	IEEE	1110588894.000
i=	1000000	NPA	1233988894.000	IEEE	1233988894.000



END