Lab 11

```python
import time

'''The main function of the program.'''
def main():
    c = 0 #Final time variable
    offset = 1000 #Offset variable
    times = [] #List for time results
    results = [] #List for results results
    o = [] #List for range results
    f = open("times.csv", "w")
    '''Runs and times the recursive algorithm'''
    for i in range(-offset, offset, 10):
        o.append(i)
        a = time.time()
        results.append(solvie(i, offset))
        b = time.time()
        times.append(b - a)
    '''Creates the CSV file.'''
    f.write("%s, %s, %s\n"%("Iterations", "Results", "Times"))
    for i in range(len(results)):
        f.write("%f, %f, %f\n"%(o[i], results[i], times[i]))
    f.close()

    '''Creates a result list and calls the recursive function'''
def solvie(n, offset):
    results = [None for i in range(offset * 2)]
    return h(n, results, offset)

'''Checks if result is saved to save time, otherwise calculates.'''
def h(n, results, offset):
    if results[n + offset] != None:
        return results[n + offset]
    if n < -5:
        results[n + offset] = h(n+4,results, offset) + h(n+2,results, offset)
        return results[n + offset]
    elif -5 <= n and n < 2:
        results[n + offset] = n * 2
        return results[n + offset]
    elif n >= 2:
        results[n + offset] = h(n-8, results, offset) - h(n-4,results, offset) + h(n-3,results, offset)
        return results[n + offset]

'''Calls main'''
if __name__ == '__main__':
```

main()

Output:

Iterations	Results	Times
-1000	-9.0237E+104	0.000242
-990	-8.1366E+103	0.000163
-980	-7.3368E+102	0.000161
-970	-6.6156E+101	0.000158
-960	-5.9653E+100	0.000158
-950	-5.3789E+99	0.000157
-940	-4.85013E+98	0.000155
-930	-4.37336E+97	0.000155
-920	-3.94346E+96	0.000154
-910	-3.55581E+95	0.000151
-900	-3.20627E+94	0.000151
-890	-2.8911E+93	0.000149
-880	-2.6069E+92	0.000149
-870	-2.35064E+91	0.000147
-860	-2.11957E+90	0.000146
-850	-1.91122E+89	0.000144
-840	-1.72334E+88	0.000144
-830	-1.55394E+87	0.000142
-820	-1.40118E+86	0.000141
-810	-1.26345E+85	0.000139
-800	-1.13925E+84	0.000139
-790	-1.02726E+83	0.000136
-780	-9.2628E+81	0.000135
-770	-8.35226E+80	0.000133
-760	-7.53123E+79	0.000134
-750	-6.79091E+78	0.00013
-740	-6.12336E+77	0.000128
-730	-5.52143E+76	0.000126
-720	-4.97867E+75	0.000128
-710	-4.48926E+74	0.000128
-700	-4.04796E+73	0.000125
-690	-3.65005E+72	0.000121
-680	-3.29125E+71	0.000122
-670	-2.96771E+70	0.000118

-660	-2.67599E+69	0.000118
-650	-2.41294E+68	0.000117
-640	-2.17574E+67	0.000116
-630	-1.96187E+66	0.000113
-620	-1.76901E+65	0.000113
-610	-1.59512E+64	0.000111
-600	-1.43832E+63	0.00011
-590	-1.29693E+62	0.000108
-580	-1.16944E+61	0.000108
-570	-1.05448E+60	0.000106
-560	-9.50828E+58	0.000104
-550	-8.57361E+57	0.000103
-540	-7.73082E+56	0.000102
-530	-6.97088E+55	0.0001
-520	-6.28563E+54	0.000099
-510	-5.66775E+53	0.0001
-500	-5.11061E+52	0.000096
-490	-4.60823E+51	0.000095
-480	-4.15524E+50	0.000093
-470	-3.74678E+49	0.000092
-460	-3.37847E+48	0.000092
-450	-3.04636E+47	0.00009
-440	-2.7469E+46	0.000089
-430	-2.47688E+45	0.000086
-420	-2.2334E+44	0.000086
-410	-2.01386E+43	0.000084
-400	-1.81589E+42	0.000082
-390	-1.63739E+41	0.00008
-380	-1.47643E+40	0.000079
-370	-1.3313E+39	0.000078
-360	-1.20043E+38	0.000078
-350	-1.08243E+37	0.000076
-340	-9.76026E+35	0.000074
-330	-8.80082E+34	0.000073
-320	-7.9357E+33	0.000072
-310	-7.15561E+32	0.00007
-300	-6.45221E+31	0.000069
-290	-5.81796E+30	0.000068
-280	-5.24605E+29	0.000066

-270	-4.73036E+28	0.000065
-260	-4.26536E+27	0.000063
-250	-3.84607E+26	0.000062
-240	-3.468E+25	0.000061
-230	-3.1271E+24	0.000059
-220	-2.8197E+23	0.000058
-210	-2.54252E+22	0.000057
-200	-2.29259E+21	0.000055
-190	-2.06723E+20	0.000053
-180	-1.86402E+19	0.000053
-170	-1.68078E+18	0.000051
-160	-1.51556E+17	0.00005
-150	-1.36658E+16	0.000048
-140	-1.23225E+15	0.000047
-130	-1.11112E+14	0.000046
-120	-1.00189E+13	0.000044
-110	-9.03406E+11	0.000044
-100	-81460044296	0.000042
-90	-7345247612	0.000041
-80	-662320564	0.00004
-70	-59721408	0.000038
-60	-5385076	0.000037
-50	-485572	0.000035
-40	-43784	0.000035
-30	-3948	0.000033
-20	-356	0.000031
-10	-32	0.000031
0	0	0.000029
10	-8	0.000033
20	152	0.000038
30	-1564	0.00004
40	8830	0.000045
50	-5206	0.000048
60	-551872	0.000052
70	7437108	0.000056
80	-56792548	0.000061
90	208551236	0.000064
100	1293730820	0.000068
110	-31154567770	0.000071

120	3.09028E+11	0.000076
130	-1.78539E+12	0.000079
140	1.30105E+12	0.000083
150	1.08043E+14	0.000088
160	-1.47601E+15	0.000091
170	1.1375E+16	0.000094
180	-4.27184E+16	0.000103
190	-2.46973E+17	0.000103
200	6.1504E+18	0.000107
210	-6.15959E+19	0.00011
220	3.60015E+20	0.000114
230	-3.12499E+20	0.000119
240	-2.11434E+22	0.000122
250	2.9289E+23	0.000126
260	-2.27786E+24	0.000131
270	8.74188E+24	0.000135
280	4.70535E+25	0.000139
290	-1.21391E+27	0.000143
300	1.22755E+28	0.000149
310	-7.25718E+28	0.000155
320	7.28469E+28	0.000157
330	4.13577E+30	0.000161
340	-5.81098E+31	0.00017
350	4.5606E+32	0.000171
360	-1.78733E+33	0.000218
370	-8.94531E+33	0.000185
380	2.39538E+35	0.000182
390	-2.446E+36	0.000185
400	1.46245E+37	0.000189
410	-1.66165E+37	0.000193
420	-8.08604E+38	0.000197
430	1.15272E+40	0.000204
440	-9.12924E+40	0.000205
450	3.65121E+41	0.000208
460	1.69656E+42	0.000214
470	-4.72564E+43	0.000217
480	4.87314E+44	0.000221
490	-2.94621E+45	0.000226
500	3.72826E+45	0.000232

510	1.58018E+47	0.000235
520	-2.28625E+48	0.00024
530	1.82712E+49	0.000244
540	-7.45277E+49	0.000249
550	-3.20926E+50	0.000253
560	9.32061E+51	0.000257
570	-9.7072E+52	0.000262
580	5.9336E+53	0.000265
590	-8.25739E+53	0.000268
600	-3.08644E+55	0.000273
610	4.53369E+56	0.000277
620	-3.65612E+57	0.000282
630	1.52007E+58	0.000288
640	6.0532E+58	0.000304
650	-1.83791E+60	0.000304
660	1.93336E+61	0.00031
670	-1.19467E+62	0.000311
680	1.80984E+62	0.000308
690	6.02539E+63	0.000311
700	-8.9889E+64	0.000317
710	7.31469E+65	0.000319
720	-3.09809E+66	0.000324
730	-1.13806E+67	0.000329
740	3.62325E+68	0.000332
750	-3.85002E+69	0.000337
760	2.40466E+70	0.000341
770	-3.93275E+70	0.000345
780	-1.17565E+72	0.00035
790	1.78192E+73	0.00036
800	-1.46316E+74	0.000358
810	6.30988E+74	0.000363
820	2.13194E+75	0.000367
830	-7.14107E+76	0.00037
840	7.66561E+77	0.000381
850	-4.83882E+78	0.000377
860	8.48429E+78	0.000382
870	2.29258E+80	0.000386
880	-3.53179E+81	0.00039
890	2.92626E+82	0.000394

900	-1.28428E+83	0.000399
910	-3.9775E+83	0.000405
920	1.40708E+85	0.000414
930	-1.52603E+86	0.000412
940	9.7344E+86	0.000418
950	-1.81914E+87	0.000434
960	-4.46804E+88	0.000439
970	6.99887E+89	0.000462
980	-5.85136E+90	0.00046
990	2.61228E+91	0.00046

Chart:

Times