Computational Physics
PHYS410

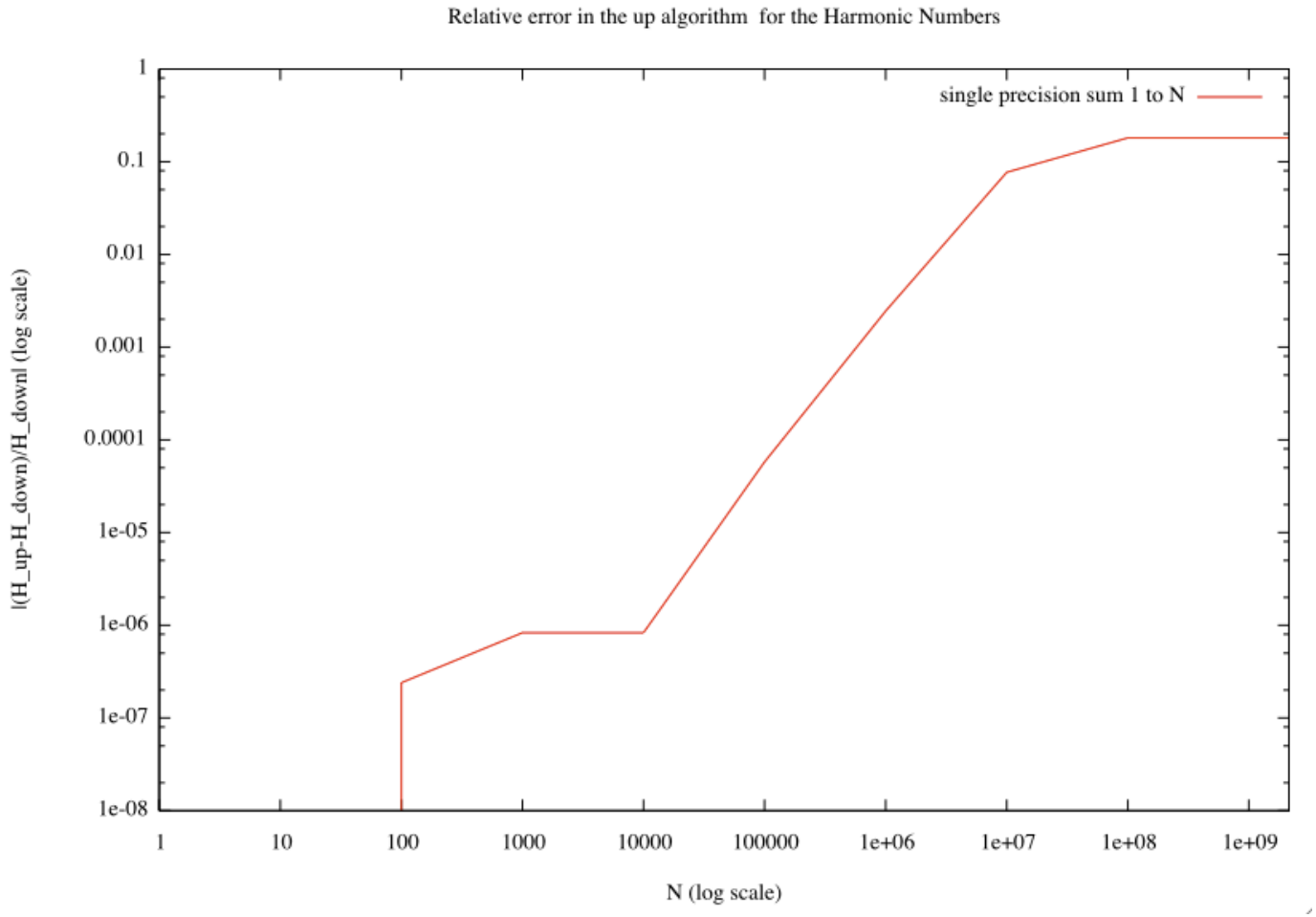
Expectations for Assignments

Suggested Process

- Read assignment. Ask clarifying questions ASAP to myself or a TA.
- Write well-documented code attempting to solve the problem (perhaps for a simpler test case initially), and generate a rough version of required data and figures.
- Now that you know “the answer” read the assignment carefully again.
- Write a declarative statement in response to any and all questions.
- Document and describe any expected or unusual phenomenal you observe (even if you can’t explain it right away).
- Write any additional statements you wish to make along with supporting evidence.
- Write conclusions that summarize and synthesize your results.
- If possible, generalize your results and suggest what you would expect if you took the assignment “one step further”. If possible, take that step.
- Generate your final data and figures, filling in gaps in the description or plots that you now realize you need to back up with evidence.
- Organize your write-up into a neat and easily readable form.
- Final check that all questions are answered, all figures are properly labeled.
- Final check that all references for all material or intellectual conversations that helped you complete the assignment/project are properly cited in your report.
- Hand in your assignment (and electronically your code)!

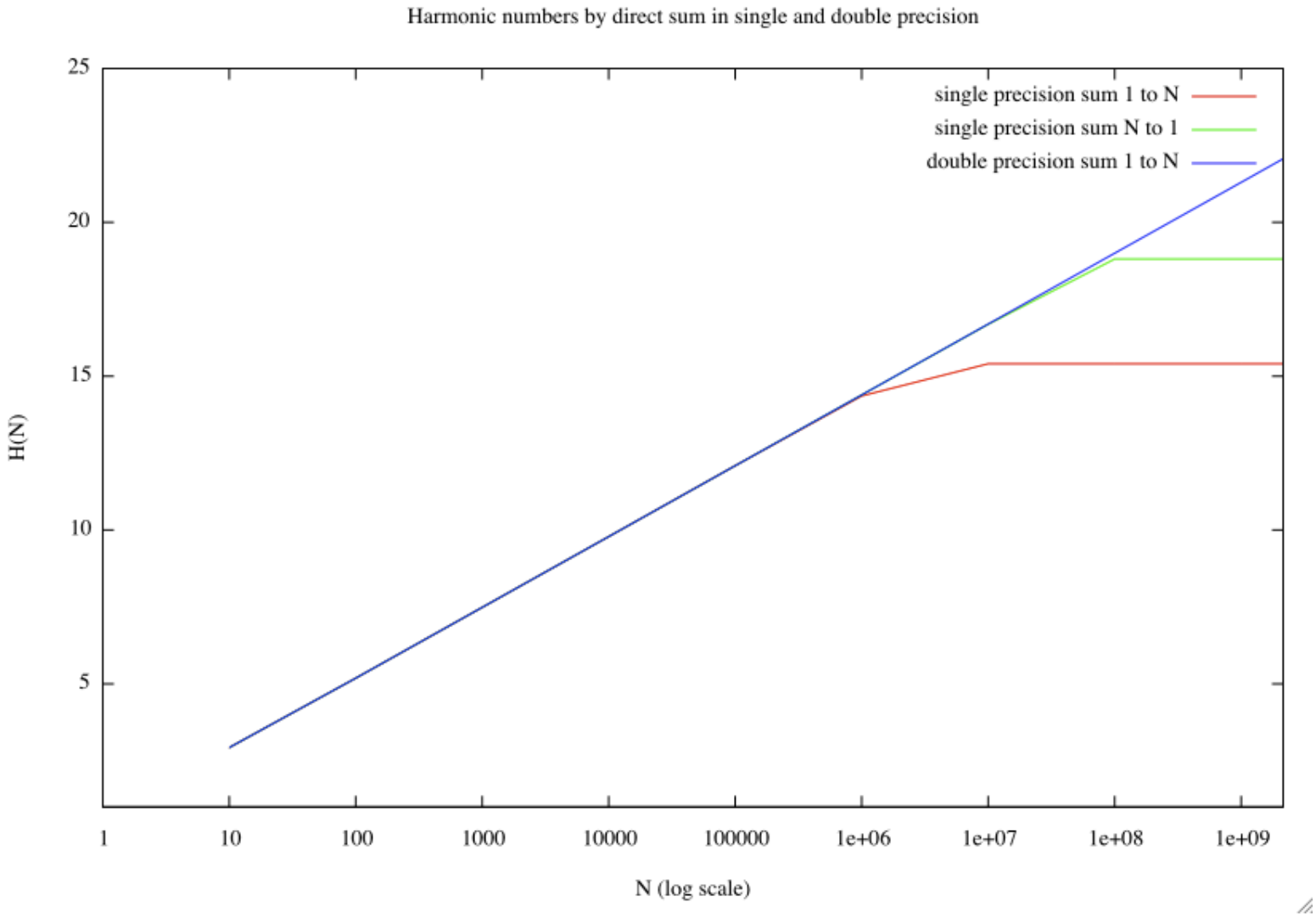
Figures

- Figures should have a descriptive title and number if you have many of them.
- Label your axes and units if appropriate.
- Label or Legend curves. It should be absolutely clear what you are plotting, and if multiple curves are present, they should be distinguisable.


Relative error in the up algorithm for the Harmonic Numbers
single precision sum 1 to N
|(H_up-H_down)/H_downl (log scale)
1
0.1
0.01
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1
10
100
1000
10000
100000
1e+06
1e+07
1e+08
1e+09
N (log scale)

Discussion Points

- For each figure or other collection of data include a self-contained figure or table caption. Can you read the caption and understand what is plotted without reading the entire report?
- Try and use a declarative paragraph to address questions or other major points.
    * Idea/Point of discussion.
    * Quantitative Evidence for Idea/Point.
    * Summary.


Harmonic numbers by direct sum in single and double precision
single precision sum 1 to N
single precision sum N to 1
double precision sum 1 to N
H(N)
N (log scale)
25
20
15
10
5
1
10
100
1000
10000
100000
1e+06
1e+07
1e+08
1e+09

A. The down algorithm is more reliable than the up algorithm over a larger range of integers. As seen in Table 1, at N=100, the floating point implementation of the up algorithm already deviates from the down implementation by 5×10^{-8} and the double precision implementations by 4×10^{-7}. This deviation increases with increasing N; for example it is at 7×10^{-4} at $N = 10^5$ compared to both the floating point down algorithm and the double precision algorithms. Thus $N = 10^5$ is the upper bound on the range of reliability for the floating point implementation of the up algorithm if a relative error of about 10^{-5} is desired. Furthermore, this implementation completely fails at N between 10^6 and 10^7 ; it yields a constant value of 15.40368271 for $N \geq 10^8$, instead of increasing. In contrast, $N = 10^6$ is the upper bound on the range of reliability of the floating point implementation of the down algorithm for a relative error of about $10^{-5.}$ Similarly it fails at N between 10^7 and 10^8 , one order of magnitude later than the up algorithm. Finally, the double implementation of the up and down algorithms also show a deviation, initially 1×10^{-13} at $N=10^4$; however, this deviation only increases to 1×10^{-10} at $N=10^{10}$, the limit of this exercise. Nonetheless, the underlying cause of the failure of the up algorithm remains the same in both floating point and double precision implementations as discussed in d). Therefore the down algorithm should be used for all precision implementations and its range of validity monitored carefully.

Presentation

- Be sure to include all required material before you attempt to include extra material. Extra material can help you to make a stronger argument.
- All things being equal a complete and concise description that conveys the same information is better.
- Be sure all your material is legible.
- The effectiveness of your presentation is determined by your audience (if a TA did not understand what you said then get feedback and restate it in a clearer way next time)
- Use feedback to improve your presentation style. "Practice makes closer to perfect more often than you used to"
- Ultimately it is up to you how you present your assignment. As presentation determines how well your results are communicated to your audience (the TAs) it can have a significant impact on your grade. Use your own judgment and don't be afraid to ask for feedback from others.