Introduction to Algorithms: 6.006
Massachusetts Institute of Technology
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Handout # 4

Problem Set 4, Problem 3

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This problem set is due **Tuesday, November 5** at **11:59PM**.

This solution template should be turned in through our submission site. [1]

For written questions, full credit will be given only to correct solutions that are described clearly *and concisely*.

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[1] Register an account, if you haven't done so. Then go to Homework, Problem Set 4, and upload your files.

Problem 4-3. [25 points] **Joan of Arcsin**

(a) [10 points] Explain how you would implement the arcsin function using Newton's Method, and the given library. It must work correctly and efficiently for all y in the given range, including the endpoints. You may assume that the given library is correct and of great accuracy.

We start with the equation $x = \arcsin(y)$. Since we can only use mathematical functions in our library with $\sin, \cos$, and $\tan$, we change this equation to $y = \sin(x)$. Then we subtract from both sides to get $\sin(x) - y = 0$. Thus, we let $f(x) = \sin(x) - y$ and find that $f'(x) = \cos(x)$. We can use the tangent line approximation to get $x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$.

(b) [10 points] Explain why one iteration of Newton's Method definitely improves your approximation to the correct answer (assuming that it is not already exactly the correct answer).

□

(c) [5 points] Explain why your iterative procedure doesn't take you outside the range $[0, \frac{\pi}{2}]$, inclusive.

Write something here!