Purdue University
West Lafayette
CS 182

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Summer 2017

Assignment 4

Due: Thursday, July 13, 2017, upload before 11:30pm

1) (10 pts.): Perform the following number systems conversions:

- $(AF3E)_{16} \Rightarrow ()_5$
- $(3451)_6 \Rightarrow ()_{10}$
- $(10111)_{16} \Rightarrow ()_8$

2) (15 pts.): Determine whether f is a function from $\mathbb{Z}$ to $\mathbb{R}$ and explain your answer if

a. $f(n) = \pm n$

b. $f(n) = \sqrt{n}$

c. $f(n) = \dfrac{1}{n^2 - 4}$

3) (10 pts.):Consider the function $f : \mathbb{Z} \to (\mathbb{N} - \{0\})$ where $f(n) = \begin{cases} 1 - 2n & n \leq 0 \\ 2n & n > 0 \end{cases}$

a. Prove that f is a bijection by showing that it is both injective and surjective.

b. Find the inverse function f^{-1}.

4) (5 pts.): Solve the recurrence relation: $A_n = 2 \cdot A_{n-1} + 3$, where $A_0 = 1$

5) (5 pts.): Show that $\sum_{j=1}^{n}(a_j - a_{j-1}) = a_n - a_0$, where $a_0, a_1, \ldots, a_n$ is a sequence of real numbers.
This type of sum is called ***telescoping****.*

6) (Programming Assignment 20 pts.):Using the Java code skeleton given to you (on piazza), implement the function *Fibonacci(n)* both iteratively and recursively. You will need to plot the runtime for both versions of the function for different values of n. Your report should include a plot that shows the difference in speed for both versions of the algorithm. You will need to discuss your findings from the plot.

7) (Programming Assignment 20 pts.): Using the Java code skeleton given to you (on piazza), implement a recursive version of the algorithm you devised for the *gas station* problem given in Assignment 2. The input to the algorithm is d the maximum mileages that can be covered using one tank, the array DIST, where DIST[i] contains the distance between gas station [i] and gas station [i+1]. Assume you start at gas station 0 with a full tank. Gas station 0 should not be added to the result set. You will need to return the list of gas stations that you will stop at. You need to minimize the number of stops you make.

Note: As you will have read on the course website, you need to submit your answers typed and as one PDF file named LastName.FirstName.4.PDF before the due date stated above. Follow the the template given at https://www.cs.purdue.edu/homes/amahmoo/cs182summer2017/homeworksolutiontemplate.pdf.