Connor Brown

Assignment 3

Due: Wednesday, October 4th, 2017, upload before 11:59pm

1) (20 pts.) Do Exercise 52 of Section 3.1 (page 204) Use the greedy algorithm to make change using quarters, dimes, nickels, and pennies for
   $C_1 = 25$, $C_2 = 10$, $C_3 = 5$, $C_4 = 1$
   a) 87 cents.
      n = 87
      i = 1, C = {25}, n = 62
      i = 1, C = {25, 25}, n = 37
      i = 1, C = {25, 25, 25}, n = 12
      i = 2, C = {25, 25, 25, 10}, n = 2
      i = 4, C = {25, 25, 25, 10, 1}, n = 1
      i = 4, C = {25, 25, 25, 10, 1, 1}, n = 0
   b) 49 cents.
      n = 49
      i = 1, C = {25}, n = 24
      i = 2, C = {25, 10}, n = 14
      i = 2, C = {25, 10, 10}, n = 4
      i = 4, C = {25, 10, 10, 1}, n = 3
      i = 4, C = {25, 10, 10, 1, 1}, n = 2
      i = 4, C = {25, 10, 10, 1, 1, 1}, n = 1
      i = 4, C = {25, 10, 10, 1, 1, 1, 1}, n = 0
   c) 99 cents.
      n = 99
      i = 1, C = {25}, n = 74
      i = 1, C = {25, 25}, n = 49
      i = 1, C = {25, 25, 25}, n = 24
      i = 2, C = {25, 25, 25, 10}, n = 14
      i = 2, C = {25, 25, 25, 10, 10}, n = 4
      i = 4, C = {25, 25, 25, 10, 10, 1}, n = 3
      i = 4, C = {25, 25, 25, 10, 10, 1, 1}, n = 2
      i = 4, C = {25, 25, 25, 10, 10, 1, 1, 1}, n = 1
      i = 4, C = {25, 25, 25, 10, 10, 1, 1, 1, 1}, n = 0
   d) 33 cents.
      n = 33
      i = 1, C = {25}, n = 8
      i = 3, C = {25, 5}, n = 3
      i = 4, C = {25, 5, 1}, n = 2
      i = 4, C = {25, 5, 1, 1}, n = 1
      i = 4, C = {25, 5, 1, 1, 1}, n = 0

2) (20 pts.) Arranging the functions in order such that each function is big-O of the next function:
Before: $19\log(n)$, $\sqrt{n}$, $n^2\log(n)$, $n^3/10^5$, 3.2^n, 2.3^n, $3n!$, $14n^n$

After: $19\log(n)$, $\sqrt{n}$, $x^3/10^5$, $n^2\log(n)$, 2.3^n, 3.2^n, $3n!$, $14n^n$

3) (20 pts.) Do Exercise 2 of Section 9.5 (page 615). Which of these relations on the set of all people are equivalence relations? Determine the properties of an equivalence relation that the others lack.
   a) {(a, b) | a and b are the same age}
   Reflexive? Yes, because it is an equality equation and x = x.
   Symmetric? Yes, because if a is the same age as b then be is the same age as a.
   Transitive? Yes, because if a is the same age as b, and b is the same age as c then a is the same age as c.

   This is an equivalence relation because it is reflexive, symmetric, and transitive.

   b) {(a, b) | a and b have the same parents}
   Reflexive? Yes, because it is an equality equation and x = x.
   Symmetric? Yes, because if a has the same parents as b, then b has the same parents as a.
   Transitive? Yes, because if a has the same parents as b, and b has the same parents as c, then a has the same parents as c.

   This is an equivalence relation because it is reflexive, symmetric, and transitive.

   c) {(a, b) | a and b share a common parent}
   Reflexive? Yes, because while a and b can each have one different parent they will both still have at least one of the same and one different or both the same or both different.
   Symmetric? Yes, because if a shares a common parent with b, then b shares a common parent with a.
   Transitive? No, because a can share a common parent with b, and b can share a common parent with c, but a and c can have 2 different parents.

   This is not an equivalence relation because it is not transitive.

   d) {(a, b) | a and b have met}
   Reflexive? No because you cannot meet yourself.
   Symmetric? Yes, because if a has met b, then b has met a.
   Transitive? No, because if a has met b, and b has met c, that doesn't mean a has met c.
   This is not an equivalence relation because it is not reflexive and not transitive.

e) {(a, b) | a and b speak a common language}
Reflexive? Yes, because they can either both not speak the same language, or both speak several and share 1 common one.
Symmetric? Yes, because if a speaks a common language with b, then b speaks a common language with a.
Transitive? No, because if a speaks a common language with b, and b speaks a common language with c, then a and c can both speak different language if all of them can speak several different languages.

This is not an equivalence relation because it is not transitive.