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CSCI 117 – Lab 7

Part 1:

```
// Generate example from class
// First function multiplies all elements of a list by constant
local X Y Generate Display DisplayHamming in
fun {Generate N}
  fun {$} (N#{Generate (N+1)}) end
end

proc {Display X N}
  fun{DisplayHamming Z Num}
  if(Num == 0) then nil
    else
    (V#F) = {Z} in
    (V|{DisplayHamming F (Num - 1)})
    end
  end

local L in
  L = {DisplayHamming X N}
  skip Browse L
  end
end

//Times Generator
local X Y Generate Display DisplayHamming Times in
fun {Generate N}
  fun {$} (N#{Generate (N+1)}) end
```

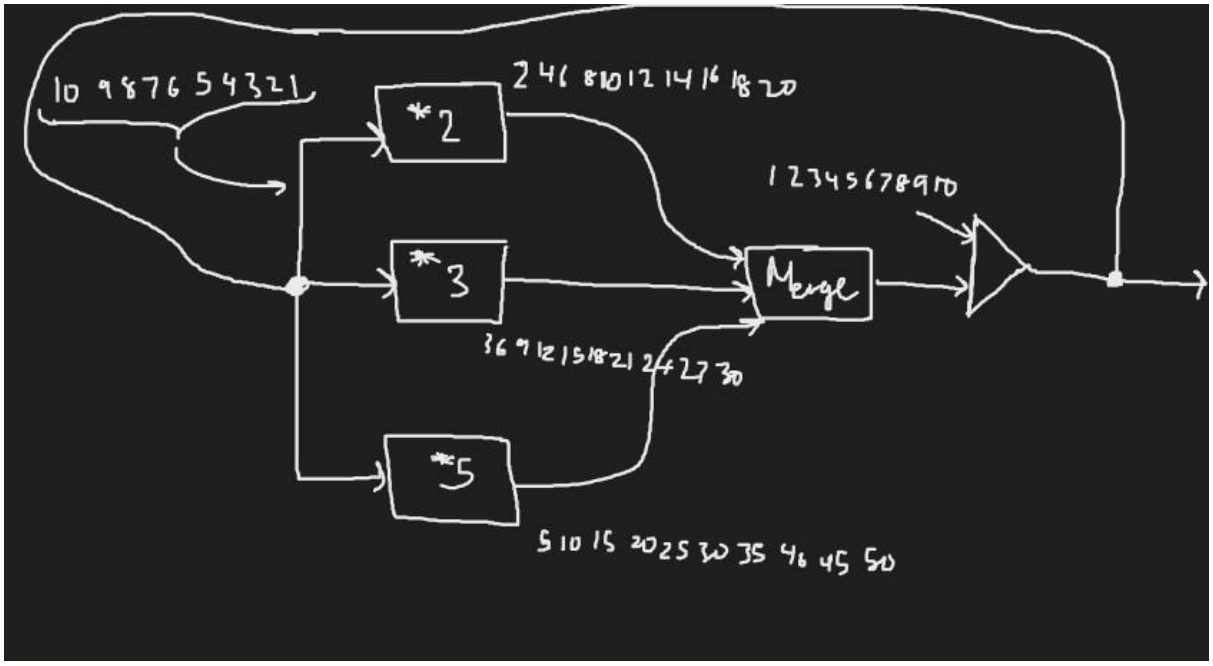
```
end

fun {Times X Y}
fun {$}
   (V#F) = {X} in
   ((V*Y) # {Times F Y})
  end
end

proc {Display X N}
  fun{DisplayHamming Z Num}
    if(Num == 0) then nil
      else
      (V#F) = {Z} in
      (V|{DisplayHamming F (Num - 1)})
      end
    end
local L in
  L = {DisplayHamming X N}
  skip Browse L
  end
end

//Merge Generator
local X Y Generate Display DisplayHamming Merge Times H in
  fun {Generate N}
    fun{$}(N#{Generate(N+1)}) end
    end
  fun {Times X Y}
    fun {$}
```

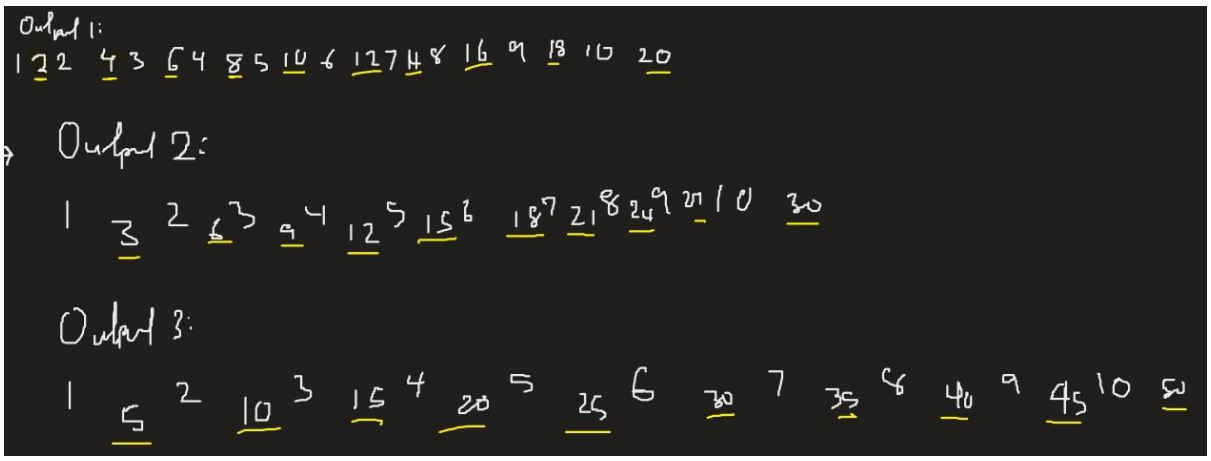
```
      (V#F) = {X} in
      ((V*Y)#{Times F Y})
    end
  end

  Merge = fun {$ X Y}
  fun {$}
  (V#F) = {X}
  (U#H) = {Y} in
     if (V < U) then (V#{Merge F Y})
     else
       if(V > U) then (U#{Merge X H})
     else (V#{Merge F H})
       end
     end
   end

H = fun {$} (1# {Merge {Times H 2}{Merge {Times H 3} {Times H 5}}})

end

proc {Display X N}
  fun {DisplayHamming Z Num}
    if(Num == 0) then nil
    else
    (V#F) = {Z} in
    (V|{DisplayHamming F (Num-1)})
  end
end
  local L in
```

```
   L = {DisplayHamming X N}
   skip Browse L
  end
end

fun{Take N G}
  if(N <= 0) then []
  else
   (M#H) = {G} in
   M|{Take N-1 H}
  end
end

// Interleave example from class
fun {Zip X Y}
  fun {$}
   (V#F) = {X} in
   (V#{Zip Y F})
  end
end

// Testing
X = {Generate 3}   // 3, 4, 5, ...
Y = {Generate 5}   // 5, 6, 7, ...
Z = {Zip X Y}      // 3, 5, 4, 6, 5, 7, ...
  local
   (V1#F1) = {Z}
   (V2#F2) = {F1}
   (V3#F3) = {F2} in
     skip Browse V1 // 3 from X
```

```
   skip Browse V2 // 5 from Y
   skip Browse V3 // 4 from X
end
```

How these 10 values are produced:





<u>Part 2:</u>

Digital Logic:

```
local GateMaker AndG OrG NotG A B S IntToNeed Out MulPlex in


   fun {GateMaker F}
```

```
   fun {$ Xs Ys} GateLoop T in
      fun {GateLoop Xs Ys}
         case Xs of nil then nil
               [] '|'(1:X 2:Xr) then
                  case Ys of nil then nil
                        [] '|'(1:Y 2:Yr) then
                           ({F X Y}|{GateLoop Xr Yr})
                  end
         end
      end
      T = thread {GateLoop Xs Ys} end   // thread isn't (yet) a returnable expression
         T
   end
end

fun {NotG Xs} NotLoop T in
   fun {NotLoop Xs}
      case Xs of nil then nil
            [] '|'(1:X 2:Xr) then ((1-X)|{NotLoop Xr})
      end
   end
   T = thread {NotLoop Xs} end          // thread isn't (yet) a returnable expression
   T
end

AndG = {GateMaker fun {$ X Y} if (X == 0) then 0 else (X*Y) end end }
OrG =  {GateMaker fun {$X Y} if (X == 1) then 1 else (X+Y) end end}

fun {IntToNeed L}
   case L of nil then nil
```

```
   [] '|' (1:X 2:Xr) then T W in
      byNeed fun {$} X end W
      T = {IntToNeed Xr}
      (W|T)
      end
end

fun {MulPlex A B S} R Z T W in
  R = {NotG S}
  Z = {AndG R A}
  T = {AndG S B}
  W = {OrG Z T}
  W
end

A = {IntToNeed [0 1 1 0 0 1]}
B = {IntToNeed [1 1 1 0 1 0]}
S = [1 0 1 0 1 1]
Out = {MulPlex A B S}

// run a loop so the MulPlex threads can finish before displaying Out
local Loop in
   proc {Loop X}
      if (X == 0) then skip Basic
      else {Loop (X-1)} end
   end
  {Loop 1000}
end

skip Browse Out
```

```
end
```

Part 2a:

```
fun {IntToNeed L}
   case L of nil then nil
   []'|' (1:X 2:Xr) then T W in
      byNeed fun {$} X end W
      T = {IntToNeed Xr}
      (W|T)
   end
end
```

Part 2b:

```
AndG = {GateMaker fun {$ X Y} if (X == 0) then 0 else (X*Y) end end }
OrG =  {GateMaker fun {$X Y} if (X == 1) then 1 else (X+Y) end end}
```

Part 2c:

```
fun {MulPlex A B S} R Z T W in
   R = {NotG S}
   Z = {AndG R A}
   T = {AndG S B}
   W = {OrG Z T}
   W
end
```

Part 2d.1:

The values for A and B are determined by the value S. If S is equal to zero, then it would not need both values A and B. If S is one, it would need the value of the other variables as well. For example, when A = 0, B = 1, and S = 1, then S will take the variables of A = 0, B = 1. If A, B, and S = 0, then S will automatically not take any values from the variables.

Part 2d.2:

Yes, they do match up with the results in Part2d.1.