CS10 Spring 2017 Midterm 1 Answers

Question 1: Sutherland's sketchpad had elements of which *programming paradigms*?

OOP (the graphical elements were objects) & Declarative (the user chose the edges to be at right angles, and it automatically solved the necessary equations)

```
reverse (word)
report  combine with (join (R) (L) ◄► input names: (L) (R)) ◄► items of (word → list (word))
```

Question 2: Sir Ken Robinson (*Changing Educational Paradigms*) would agree with… none of these.

Question 3: Which of the following is a true statement based on the Privacy lecture? none of these.

```
lowest-paid millionaire (salaries :)
report  combine with (▢ min ▢) items of (keep items such that (not (▢ < 1000000)) from (salaries))
```

Question 4: Which of the following is a true statement based on the AI lecture? all of them.

Question 5: You're comfy in bed. You get up if you're thirsty. You *also* get up if you're hungry. What expression captures when you *stay* in bed?

<not <thirsty? or hungry?>>, <<not thirsty?> and <not hungry?>>

```
double non-millionaires (salaries :)
report  map (2 × ▢) only (▢ < 1000000) elements from (salaries)
```

Question 6: Which numbers are equal to the Ternary (base 3) number 120_3? $1\times3^2+2\times3^1+0\times3^0 = 9+6 = 15_{10} = F_{16} = 1111_2$

```
map (mapper λ) only (predicate λ) elements from (data :)
report  map (if (predicate) on ▢ then (mapper) it otherwise return it) over (data) ◄►
```

Question 7a: Reverse letters of a word. C, M

Question 7b: Given a list of salaries, return the salary of the lowest-paid millionaire. C←K

Question 7c: Given a list of salaries, return the salaries after everyone below a million is doubled (and all those at a million or above remain the same). M

```
if (predicate λ) on (elt) then (mapper λ) it otherwise return it
if (call (predicate) with inputs (elt) ◄►)
  report (call (mapper) with inputs (elt) ◄►)
else
  report (elt)
```

Question 8a: love (3) → x---o

```
reverse (word)
report  list → word  map (letter (▢) of (word)) over (numbers from (length of (word)) to 1)
```

Question 8b: love (4) → xx---o--o

Question 8c: What are the first three and last three letters of love (9999)? xxx … xxo (the way to think about this is that the left edge always continues to add xs with the "join x love(day-1)" … and if the left edge is all xs, then the right edge is the reverse of that due to "reverse(love(day-2))" with an o at the end)

```
love (day #)
if (day < 3)
  report (-)
else
  report (join (x) (love (day – 1)) (-) (reverse (love (day – 2))) (o) ◄►)
```

Question 8d: For the following, choose either **Possible** or **Impossible** if it's *ever possible* to do these things someday.

- Hang out *four* times in a row (i.e., "**----**") **IMPOSSIBLE**. The ends of a love sequence for day ≥ 3 are x and o respectively. So the middle "-" will always be buffeted by an x or o, and there's no other way to have dashes in there, aside from recursive calls to love that have three in a row from love(3).
- Hug immediately followed by a kiss (i.e., "**ox**") **POSSIBLE**. Remember from 8c that the right two letters of love's output (for days ≥ 5) is always "xo". That means that for days ≥ 7 (because the reverse is wrapped around recursive call to "day -2") that "xo" will be reversed in the middle to be an "ox".
- Hug twice in a row (i.e., "**oo**") **IMPOSSIBLE**. Note that os only appear on the right, and next to a reversed recursive call. The left of any love (with day ≥ 3) is always x, so when reversed is next to the o on the right, so there's no "oo" there. The right of any love (with day ≥ 3) is always o, so when reversed the o sits next the "-", so there's no "oo" there either. Finally, when we check love (with day < 3), it only adds dashes, so no o there either.