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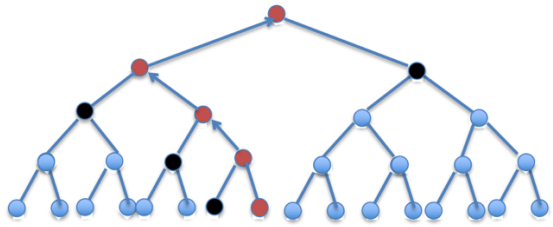
Question 3

1024 apples = 2^{10}, so $n = 10$

Place all the apples as leaves in a binary tree. Use the pan balance to compare an adjacent pair of apples and promote the heavier apple to the next level. Continue until we reach the root node, which indeed will be the largest apple (shown in red).

This process would take $2^n - 1$ comparisons, i.e. 1023 comparisons.

The below is a screenshot taken from the hints page for assignment 1, displaying the process.



We can infer that the second largest apple, denoted in black (as an example), which would have been compared against the largest apple at each level.

There are n such possibilities of this 2nd largest apple and so by brute force this is done at maximum $n - 1$ times, i.e. 9 weightings.

And so,

$$2^n - 1 + (n - 1)$$

$2^{10} - 1 + (10 - 1) = 1032$ weightings, as required.