Question 2

a(x,y)	x=0	x=1	x=2	x=3	x=4
y=0	1	2	3	5	13
y=1	2	3	5	13	2^16 - 3
y=2	3	4	7	29	2^(2^16) - 3
y=3	4	5	9	2^6 - 3	
y=4	5	6	11	2^7 - 3	
y=5	6	7	13	2^8 - 3	

NeedlesslyRecursive.a(4, 2) = 2^(2^16) - 3

Question 3

(a) worst-case complexity: $\Theta(2^n)$
(b) worst-case complexity: $\Theta(n)$

Question 4

a)

1, 9, 17, 21, 20, 8, 2, 5, 81, 83, 23
1, 2, 17, 21, 20, 8, 9, 5, 81, 83, 23
1, 2, 5, 21, 20, 8, 9, 17, 81, 83, 23
1, 2, 5, 8, 20, 21, 9, 17, 81, 83, 23
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1, 2, 5, 8, 9, 17, 20, 21, 81, 83, 23
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1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

b)

9, 81, 17, 21, 20, 8, 2, 5, 1, 83, 23
9, 17, 81, 21, 20, 8, 2, 5, 1, 83, 23
9, 17, 21, 81, 20, 8, 2, 5, 1, 83, 23
9, 17, 21, 20, 81, 8, 2, 5, 1, 83, 23
9, 17, 20, 21, 81, 8, 2, 5, 1, 83, 23
9, 17, 20, 21, 8, 81, 2, 5, 1, 83, 23
9, 17, 20, 8, 21, 81, 2, 5, 1, 83, 23
9, 17, 8, 20, 21, 81, 2, 5, 1, 83, 23
9, 8, 17, 20, 21, 81, 2, 5, 1, 83, 23
8, 9, 17, 20, 21, 81, 2, 5, 1, 83, 23
8, 9, 17, 20, 21, 2, 81, 5, 1, 83, 23
8, 9, 17, 20, 2, 21, 81, 5, 1, 83, 23
8, 9, 17, 2, 20, 21, 81, 5, 1, 83, 23
8, 9, 2, 17, 20, 21, 81, 5, 1, 83, 23
8, 2, 9, 17, 20, 21, 81, 5, 1, 83, 23
2, 8, 9, 17, 20, 21, 81, 5, 1, 83, 23
2, 8, 9, 17, 20, 21, 5, 81, 1, 83, 23
2, 8, 9, 17, 20, 5, 21, 81, 1, 83, 23
2, 8, 9, 17, 5, 20, 21, 81, 1, 83, 23
2, 8, 9, 5, 17, 20, 21, 81, 1, 83, 23
2, 8, 5, 9, 17, 20, 21, 81, 1, 83, 23
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2, 5, 8, 1, 9, 17, 20, 21, 81, 83, 23
2, 5, 1, 8, 9, 17, 20, 21, 81, 83, 23
2, 1, 5, 8, 9, 17, 20, 21, 81, 83, 23
1, 2, 5, 8, 9, 17, 20, 21, 81, 83, 23
1, 2, 5, 8, 9, 17, 20, 21, 81, 23, 83
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

c)

9, 81, 17, 21, 20, 8, 2, 5, 1, 83, 23
9, 17, 81, 21, 20, 8, 2, 5, 1, 83, 23
9, 17, 21, 81, 20, 8, 2, 5, 1, 83, 23
9, 17, 20, 21, 81, 8, 2, 5, 1, 83, 23
8, 9, 17, 20, 21, 81, 2, 5, 1, 83, 23
2, 8, 9, 17, 20, 21, 81, 5, 1, 83, 23
2, 5, 8, 9, 17, 20, 21, 81, 1, 83, 23

1, 2, 5, 8, 9, 17, 20, 21, 81, 83, 23
1, 2, 5, 8, 9, 17, 20, 21, 81, 83, 23
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

d)

81, 9, 17, 21, 20, 8, 2, 5, 1, 83, 23
23, 9, 17, 21, 20, 8, 2, 5, 1, 83, 81
1, 9, 17, 21, 20, 8, 2, 5, 23, 81, 83
1, 9, 17, 21, 20, 8, 2, 5, 23, 81, 83
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1, 2, 5, 8, 9, 20, 17, 21, 23, 81, 83
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

e)

9, 81, 17, 21, 8, 20, 2, 5, 1, 23, 83
9, 17, 21, 81, 2, 5, 8, 20, 1, 23, 83
2, 5, 8, 9, 17, 20, 21, 81, 1, 23, 83
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

f)

81, 9, 17, 21, 20, 8, 2, 5, 1, 83, 23
81, 9, 17, 21, 83, 8, 2, 5, 1, 20, 23
81, 9, 17, 21, 83, 8, 2, 5, 1, 20, 23
81, 9, 17, 21, 83, 8, 2, 5, 1, 20, 23
81, 83, 17, 21, 9, 8, 2, 5, 1, 20, 23
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21, 1, 17, 9, 20, 8, 2, 5, 23, 81, 83

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2, 1, 5, 8, 9, 17, 20, 21, 23, 81, 83
2, 1, 5, 8, 9, 17, 20, 21, 23, 81, 83
1, 2, 5, 8, 9, 17, 20, 21, 23, 81, 83

g)

0: 20
1: 81, 21, 1
2: 2
3: 83, 23
4:
5: 5
6:
7: 17
8: 8
9: 9

0: 1, 2, 5, 8, 9
1: 17
2: 20, 21, 23
3:
4:
5:
6:
7:
8: 81, 83
9:

Question 5

Exchange: comparing the first element with each following element of the array and making any necessary swaps

Insertion: similar to sorting cards where the element is pushed to the correct position

Selection: choosing the smallest element and swapping with the front element

Merge: sorting the elements in sections and combining the results at the end

Distribution: elements are distributed to multiple intermediate structures, which are then gathered and placed in the right order

Hybrid: when two or more different sorting algorithms are being used during the sorting process.

Concurrent: works best on parallel processors when sorting elements in an array

Impractical: algorithms are meant to be bad with a long run time when sorting elements

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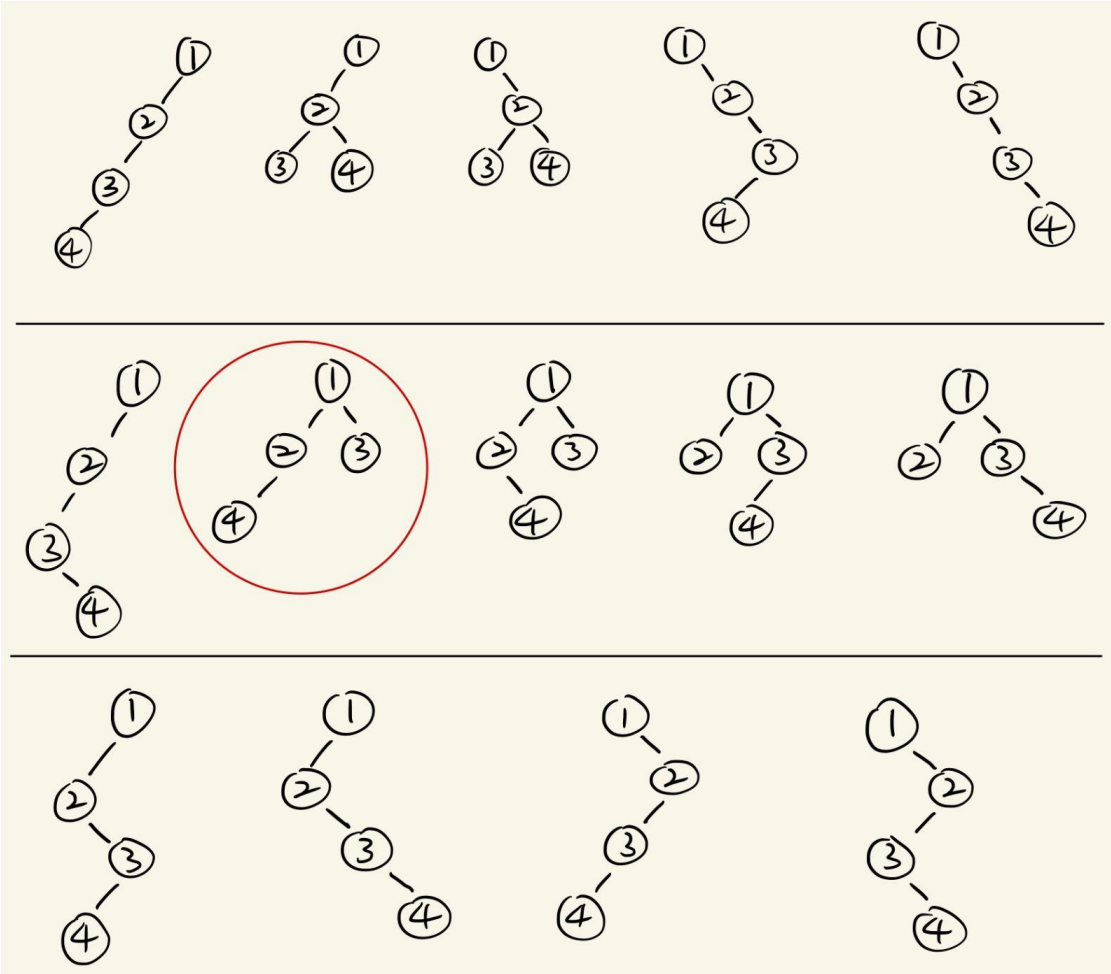
Question 7

a) 16
b) 15
c) H, N, F, C, J, O, P, L, M
d) G
e) 2
f) 4
g) A, D
h) J, K, L, M, O, P
i) H, I, J, K, L, M
j) 4
k) 6
l) 3
m) <P K G D A B E>
n) 4
o) A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P
p) A, B, E, H, I, N, F, C, D, G, J, K, O, P, L, M

Questions 8


1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4