Problem Solving Through Programming in C

Tutorial Session 9

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Bubble sorting

Q. How can you improve the best-case efficiency in bubble sort? (The input is already sorted)

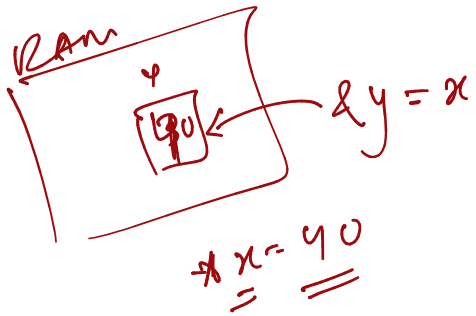
a)
```
boolean swapped = false;
for(int j=arr.length-1; j>=0 && swapped; j--)
{
        swapped = true;
        for(int k=0; k<j; k++)
        {
                if(arr[k] > arr[k+1])
                {
                        int temp = arr[k];
                        arr[k] = arr[k+1];
                        arr[k+1] = temp;
                        swapped = false;
                }
        }
}
```

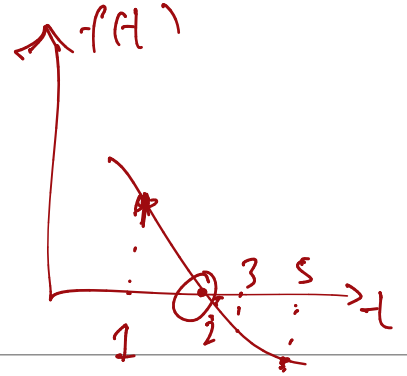
b)
```
boolean swapped = true;
for(int j=arr.length-1; j>=0 && swapped; j--)
{
        swapped = false;
        for(int k=0; k<j; k++)
        {
                if(arr[k] > arr[k+1])
                {
                        int temp = arr[k];
                        arr[k] = arr[k+1];
                        arr[k+1] = temp;
                }
        }
}
```

c)
```
boolean swapped = true;
for(int j=arr.length-1; j>=0 && swapped; j--)
{
        swapped = false;
        for(int k=0; k<j; k++)
        {
                if(arr[k] > arr[k+1])
                {
                        int temp = arr[k];
                        arr[k] = arr[k+1];
                        arr[k+1] = temp;
                        swapped = true;
                }
        }
}
```

d)
```
boolean swapped = true;
for(int j=arr.length-1; j>=0 && swapped; j--)
{
        for(int k=0; k<j; k++)
        {
                if(arr[k] > arr[k+1])
                {
                        int temp = arr[k];
                        arr[k] = arr[k+1];
                        arr[k+1] = temp;
                        swapped = true;
                }
        }
}
```

Miscellaneous





Q. What is the output of the following program?

```
# include <stdio.h>
void func(int x)
{
   x = 40;
}

int main()
{
 int y = 30;
 func(y);
 printf("%d", y);
 return 0;
}
```

a) 40
b) 30
c) Runtime error
d) Compilation error

Q. Assuming an initial range [1,5], the second (at the end of 2 iterations) iterative value of the root of $te^{-t} - 0.3 = 0$ using the bisection method is (Note: you need to find the root, not the function value)

$f(t) = te^{-t} - 0.3$

$f(t) \to 0$. at what t?

roots of the f^n.

$f(1) = 0.067$

$f(5) = -0.266$

$f\left(\frac{1+5}{2} = 3\right)$ 1st iter.

$= f(3) = -0.151$

$f\left(\frac{1+3}{2} = 2\right)$ 2nd iter.

$= f(2) = -0.03$

$f(1.5) =$ ___

(2)

Miscellaneous

Q. Find the output of the following program

```
#include <stdio.h>
int main()
{
    int *ptr, a = 12;
    ptr = &a;
    *ptr  = *ptr - 2**ptr;
    printf("%d, %d", *ptr, a);
    return 0;
}
```

ptr points to the location of a

ptr → a memory location

*ptr = 12

*ptr = 12 - 2*12 = -12

-12, -12

output

Q. What is the solution of the equation given below using the Bisection Method up to four decimal places? (Consider the root lying on positive quadrant only and compute the root till five iterations only)

$$f(x) = xe^{2x} - 3x^2 - 5$$

f(0) = -5

f(1) = -0.611

f(2) = 92.1962

1st iter

f(1.5) = 18.38

2nd iter

f(1.25) = 5.54

3rd iter

f(1.125) = 1.877

4th iter

f(1.0625) = 0.509

5th iter

f(1.03125) = -0.079

1.0312

root after 5 iterations = 1.03125 ≈ 1.0312

Miscellaneous

pointer which points nowhere

dangling pointer.

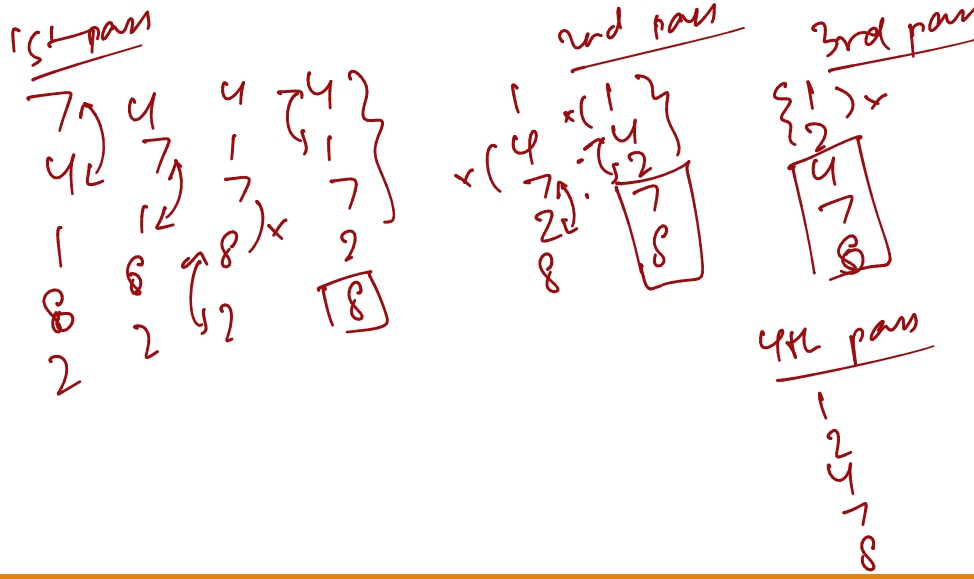
Q. What are the correct intermediate steps of the following data set when it is being sorted with the bubble sort? 7,4,1,8,2 (ascending order)

a) 4,7,1,8,2→4,1,7,2,8→4,1,2,7,8→1,4,2,7,8→1,2,4,7,8

b) 4,7,1,8,2→4,1,7,8,2→4,1,7,2,8→1,4,7,2,8→1,4,2,7,8→1,2,4,7,8

c) 4,7,1,8,2→1,4,7,8,2→1,4,2,7,8→1,2,4,7,8

d) 4,7,1,8,2→4,7,1,2,8→1,4,7,2,8→1,4,2,7,8→1,2,4,7,8



Q. Which of the following statement is correct for the 2 arrays with respect to A and B.

```
int *x[5];
int *(y[5]);
```

A. Array of pointers → each element is a pointer

B. Pointer to an array → pointer which points to the first element of an array

a) x is A, y is B

b) x is A, y is A

c) x is B, y is A

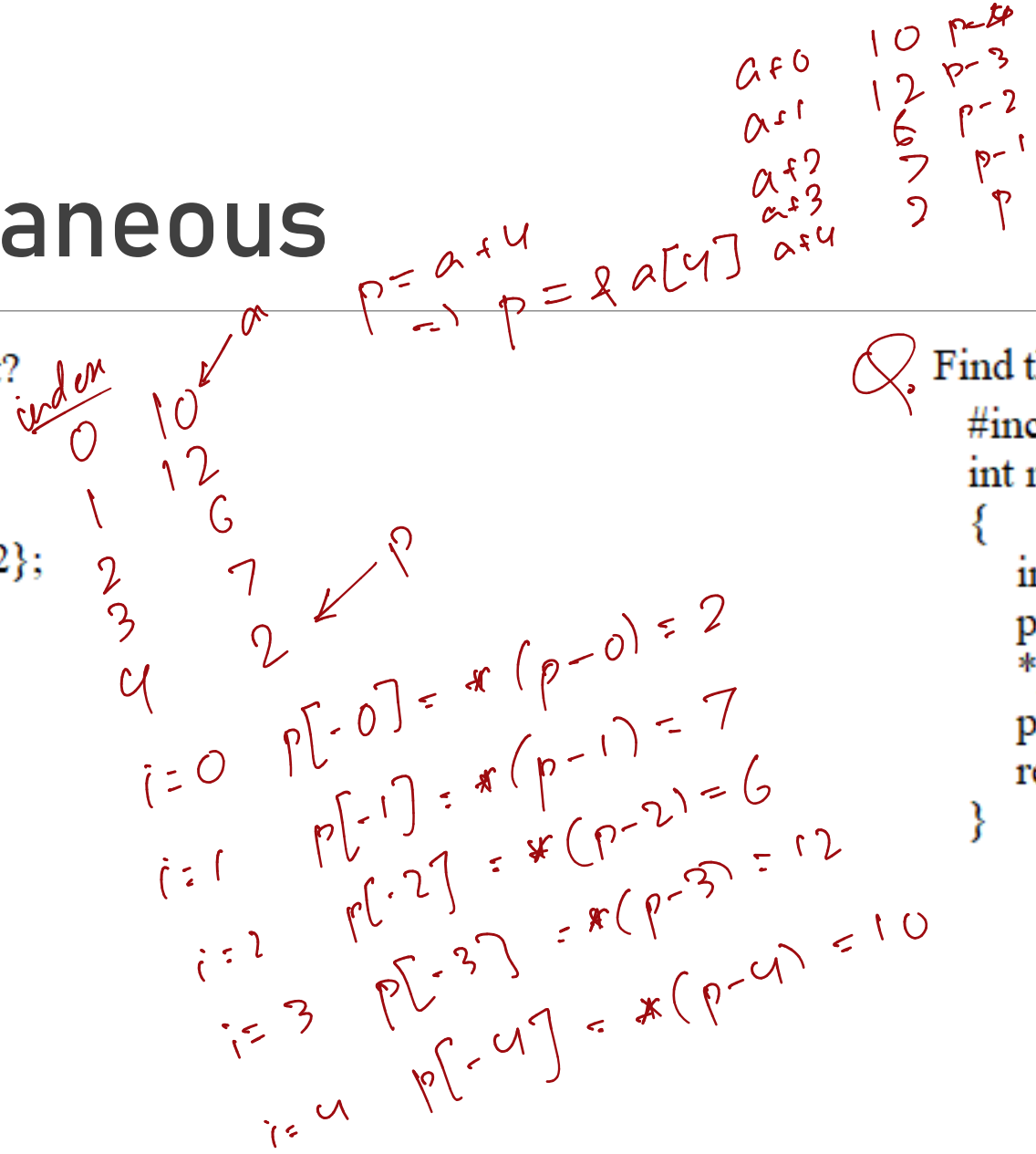
d) y is B, y is B

Miscellaneous

Q. What will be the output?

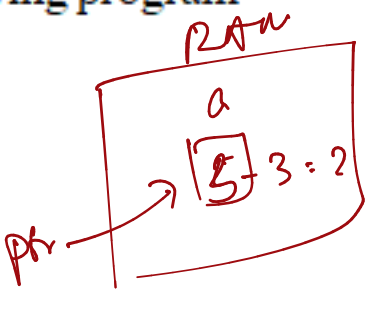
```
#include <stdio.h>
int main(void)
{
int a[ ] = {10, 12, 6, 7, 2};
int i, *p;
p=a+4;
for(i=0; i<5; i++)
printf("%d ", p[-i]);
return 0;
}
```

a) 10 12 6 7 2
b) 10 12 6 7
c) 2 7 6 12
d) 2 7 6 12 10



Q. Find the output of the following program

```
#include <stdio.h>
int main()
{
    int *ptr, a = 5;
    ptr = &a;
    *ptr  =*ptr - 3;
    printf("%d,%d ", *ptr, a);
    return 0;
}
```



2, 2

Miscellaneous

sort in ascending order.

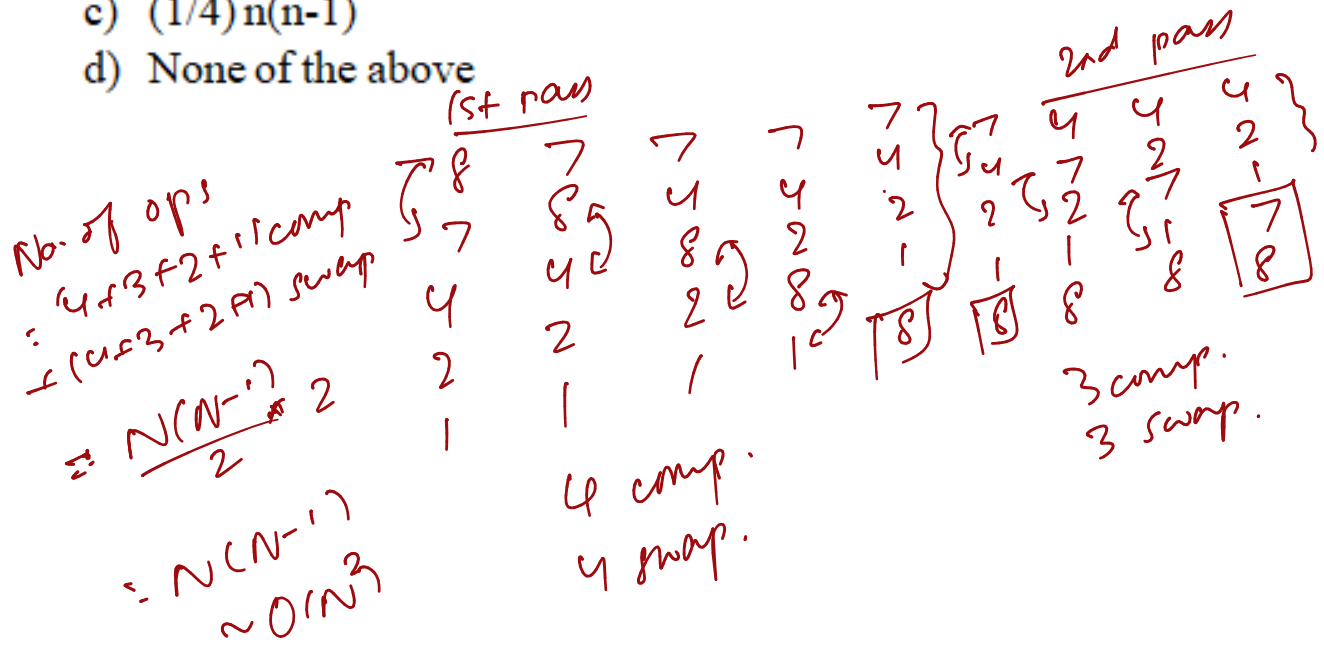
8 7 4 2 1

worst case complexity => max no. of comparisons & swapping ops

Q. What maximum number of comparisons can occur when a bubble sort is implemented? Assume there are n elements in the array.

a) (1/2) (n-1)
b) (1/2) n(n-1)
c) (1/4) n(n-1)
d) None of the above

+ $\frac{n(n-1)}{2}$ swaps

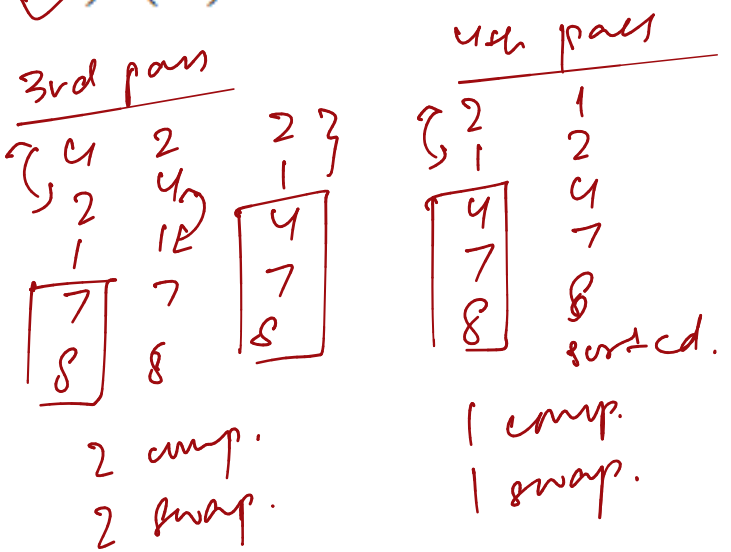


What is the worst-case complexity of bubble sort?

a) O(N log N)
b) O(log N)
c) O(N)
d) $O(N^2)$

best case ~ O(N)

avg case ~ $O(N^2)$



Miscellaneous

What is the output of the code?

```
#include <stdio.h>
int main(){
    float (*x)[7][2];
    printf("%lu", sizeof(*x));
    return 0;
}
```

a) 14
b) 112
c) 28
d) 56

Q: What is the pointer expression for accessing arr[1][5][3]?

a) ((*(arr+1)+5)+3)
b) (*(*(arr+1)+5)+3)
c) *(*(*(arr+1)+5)+3)
d) *(*(*(*arr+1)+5)+3)