

Loops and Arrays

Lecture 4

Assignments

1. What is the output of the following program?

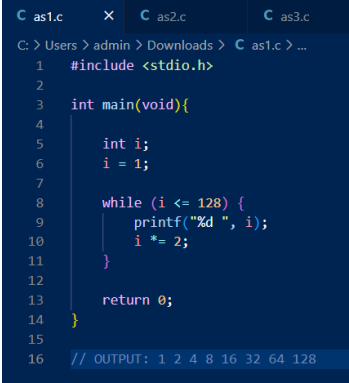
```
#include <stdio.h>

int main(void)
{
    int i;

    i = 1;
    while (i <= 128) {
        printf("%d ", i);
        i *= 2;
    }

    return 0;
}
```

Save your code as as1.c

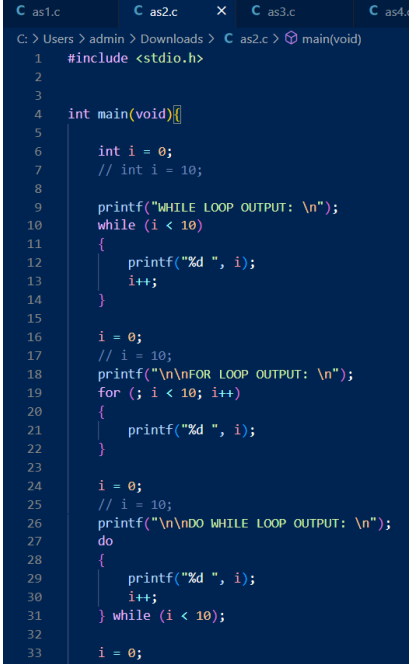
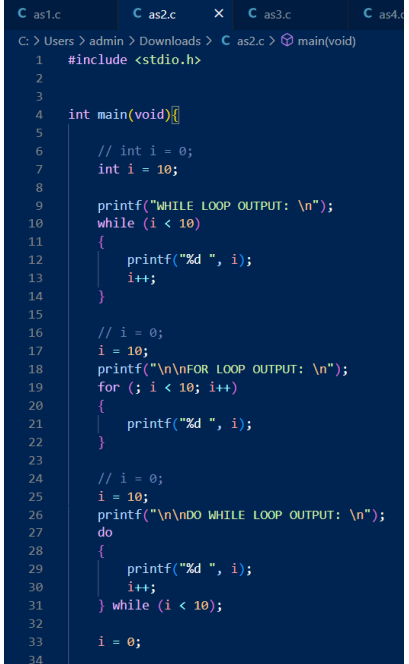

1 2 4 8 16 32 64 128

2. Which one of the following statements is not equivalent to the other two (assuming that the loop bodies are the same)?

- a) while (i < 10) {...}
- b) for (; i < 10;) {...}
- c) do {...} while (i < 10);

Save your code as as2.c

if i = 0	if i = 10
-----------------	------------------

 <pre> C as1.c C as2.c X C as3.c C as4.c C:\Users> admin > Downloads > C as2.c > main(void) 1 #include <stdio.h> 2 3 4 int main(void){ 5 6 int i = 0; 7 // int i = 10; 8 9 printf("WHILE LOOP OUTPUT: \n"); 10 while (i < 10) 11 { 12 printf("%d ", i); 13 i++; 14 } 15 16 i = 0; 17 // i = 10; 18 printf("\n\nFOR LOOP OUTPUT: \n"); 19 for (; i < 10; i++) 20 { 21 printf("%d ", i); 22 } 23 24 i = 0; 25 // i = 10; 26 printf("\n\nDO WHILE LOOP OUTPUT: \n"); 27 do 28 { 29 printf("%d ", i); 30 i++; 31 } while (i < 10); 32 33 i = 0; </pre> <div data-bbox="370 863 631 1071"> <p>WHILE LOOP OUTPUT: 0 1 2 3 4 5 6 7 8 9</p> <p>FOR LOOP OUTPUT: 0 1 2 3 4 5 6 7 8 9</p> <p>DO WHILE LOOP OUTPUT: 0 1 2 3 4 5 6 7 8 9</p> </div>	 <pre> C as1.c C as2.c X C as3.c C as4.c C:\Users> admin > Downloads > C as2.c > main(void) 1 #include <stdio.h> 2 3 4 int main(void){ 5 6 // int i = 0; 7 int i = 10; 8 9 printf("WHILE LOOP OUTPUT: \n"); 10 while (i < 10) 11 { 12 printf("%d ", i); 13 i++; 14 } 15 16 // i = 0; 17 i = 10; 18 printf("\n\nFOR LOOP OUTPUT: \n"); 19 for (; i < 10; i++) 20 { 21 printf("%d ", i); 22 } 23 24 // i = 0; 25 i = 10; 26 printf("\n\nDO WHILE LOOP OUTPUT: \n"); 27 do 28 { 29 printf("%d ", i); 30 i++; 31 } while (i < 10); 32 33 i = 0; 34 </pre> <div data-bbox="984 863 1255 1071"> <p>WHILE LOOP OUTPUT: 0 1 2 3 4 5 6 7 8 9</p> <p>FOR LOOP OUTPUT: 0 1 2 3 4 5 6 7 8 9</p> <p>DO WHILE LOOP OUTPUT: 10</p> </div>
<p>c) do while loop is NOT equivalent to the other two loop bodies since it will still execute statement even when value of i does not satisfy the condition.</p>	

- Convert item 1 into an equivalent for statement. You can validate your answer by checking if the produced outputs by both the while and for statements are similar.

Save your code as as3.c

C as1.cC as2.cC as3.cX

C: > Users > admin > Downloads > C as3.c > ...

```
1  #include <stdio.h>
2
3
4  int main(void){
5
6      int i;
7      i = 1;
8
9      printf("WHILE LOOP OUTPUT: \n");
10     while (i <= 128) {
11         printf("%d ", i);
12         i *= 2;
13     }
14
15     printf("\n");
16
17     printf("\nFOR LOOP OUTPUT: \n");
18     for (i = 1; i <= 128; )
19     {
20         printf("%d ", i);
21         i *= 2;
22     }
23
24
25     return 0;
26 }
```

WHILE LOOP OUTPUT:

1 2 4 8 16 32 64 128

FOR LOOP OUTPUT:

1 2 4 8 16 32 64 128

4. Write a code that computes for the power of two:

TABLE OF POWERS OF TWO

n 2 to the n

n	2 to the n
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512

<pre>C: > Users > admin > Downloads > C as4.c > ... 1 #include <stdio.h> 2 3 4 int main(void){ 5 6 int i = 0, count, n = 1; 7 8 printf("Enter an integer as boundary of the table: "); 9 scanf("%d", &count); 10 11 printf("\n TABLE OF POWERS OF TWO "); 12 printf("\n====="); 13 printf("\nn\t2 to the power of n"); 14 printf("\n=====\\n"); 15 16 for (; i <= count; i++) 17 { 18 if (i == 0) 19 { 20 printf("%d\\t\\t1\\n", i); 21 } 22 else 23 { 24 printf("%d\\t\\t%d\\n", i, n *= 2); 25 } 26 } 27 28 return 0; 29 30 }</pre>	<pre>Enter an integer as boundary of the table: 10 TABLE OF POWERS OF TWO ===== n 2 to the power of n ===== 0 1 1 2 2 4 3 8 4 16 5 32 6 64 7 128 8 256 9 512 10 1024</pre>
--	---

5. Write a program that displays a one-month calendar.

```
Enter number of days in month: 31
Enter the starting day of the week (1=Sun, 7=Sat): 3

  1  2  3  4  5
 6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
```

There should be a user prompt to set:

- The number of days
- The day of the week on which the month begins.

Additionally, add checkers to validate whether the days entered are valid. For instance, the following number of days are invalid: 32, -1, 0, 27.

This addition will be a good refresher to our previous topic, selection statements.

Save your code as as5.c

```

C: > Users > admin > Downloads > C as5.c > main(void)
1  #include <stdio.h>
2  int main(void){
3
4      int space = 1, date = 1, day, ndays;
5
6      printf("Enter the number of days in the month: ");
7      scanf("%d", &ndays);
8
9      printf("\nEnter which day of the week the month starts (1 = Sun, 7 = Sat): ");
10     scanf("%d", &day);
11
12     if (ndays < 28 || ndays > 31 && day < 1 || day > 7)
13     {
14         printf("\nError: Enter the correct number of days and which day the month starts.");
15     }
16     else
17     {
18         printf("\n Su Mo Tu We Th Fr Sa\n");
19
20         for (; space < day; space++) {
21             printf(" ");
22         }
23
24         for (; date <= ndays; space++, date++)
25         {
26             printf("%3d", date);
27             if (space % 7 == 0)
28             {
29                 printf("\n");
30             }
31         }
32
33         printf("\n");
34
35         return 0;
36     }
37 }

```

Enter the number of days in the month: 31

Enter which day of the week the month starts (1 = Sun, 7 = Sat): 5

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

6. In the program below, an array named pathway contains eight bool values. Each bool element refers to whether a pathway is open or close for transportation.

Only pathways 0 and 2 are open while the rest are still close due to road constructions and fixings.

```

1  #include <stdio.h>
2  #include <stdbool.h>
3
4  #define NUM_PATHWAYS ((int) (sizeof(pathway) / sizeof(pathway[0])))
5
6  int main(){
7
8      /*
9
10     A boolean array that contains true/false values referring to
11     whether a certain pathway is open/close for transportation.
12
13     Only pathways 0 and 3 are open for transportation. The rest are close.
14
15     */
16     bool pathway[NUM_PATHWAYS] = {true, false, true, false, false, false, false, false};
17
18     for (int i = 0; i < NUM_PATHWAYS; i++){
19
20         /*
21
22         Display the status of each pathway.
23
24         Remember that pathway is type bool so its elements are either true/false - 1/0.
25
26         */
27
28         if (pathway[i]){
29             printf("pathway[%d] is open \n", i);
30         }
31         else{
32             printf("pathway[%d] is close \n", i);
33         }
34     }
35
36     return 0;
37 }

```

- Revise line 16 such that you use a designated initializer to set pathways 0 and 2 to true, and the rest will be false. Make the initializer as short as possible.
- Revise line 16 such that the initializer will be short as possible (without using a designated initializer)

```

C: > Users > admin > Downloads > C as6.c > ...
1 #include <stdio.h>
2 #include <stdbool.h>
3 #define NUM_PATHWAYS ((int) (sizeof(pathway) / sizeof(pathway[0])))
4
5 int main(){
6
7     bool pathway[8] = {[0] = true, [2] = true};
8     bool pathway[8] = {[0] = 1, [2] = 1};
9     bool pathway[8] = {true, false, true};
10    bool pathway[8] = {1, 0, 1};
11
12    for (int i = 0; i < NUM_PATHWAYS; i++)
13    {
14        if (pathway[i])
15        {
16            printf("pathway[%d] is open. \n", i);
17        }
18        else
19        {
20            printf("pathway[%d] is close. \n", i);
21        }
22    }
23
24
25
26    return 0;
27 }

```

```

pathway[0] is open.
pathway[1] is close.
pathway[2] is open.
pathway[3] is close.
pathway[4] is close.
pathway[5] is close.
pathway[6] is close.
pathway[7] is close.

```

For item 6a, see first two declarations.

For item 6b, see third and last declarations.

7.

```

C as7.c
C: > Users > ACER > Downloads > C as7.c > main()
1 #include <stdio.h>
2
3 // macro definition for size of rows and columns of multidimensional array
4 #define ROWS 9
5 #define COLS 9
6
7 int main(){
8
9     // declare variables as int for operations that require int values
10    // set variables to certain values for iteration and to access array values
11    int i, loc, at_point, stationC = 2, stationD = 3;
12
13    // declare array as char since letters are used; this is for printing labels
14    char label[ROWS] = {'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I'};
15
16    // declare array as int and initialize with its values
17    int road_networks[ROWS][COLS] = {
18        {1, 1, 0, 0, 0, 1, 0, 0, 0},
19        {1, 1, 1, 0, 0, 0, 0, 0, 0},
20        {0, 1, 1, 0, 1, 1, 0, 0, 1},
21        {0, 0, 0, 1, 1, 0, 0, 0, 0},
22        {1, 0, 1, 0, 0, 1, 0, 0, 0},
23        {1, 0, 0, 1, 0, 0, 1, 0, 0},
24        {0, 0, 0, 0, 1, 0, 1, 1},
25        {0, 0, 0, 0, 0, 0, 0, 1, 1},
26        {0, 0, 0, 0, 0, 0, 0, 1, 1}};
27
28    // print the table with the adjacency matrix
29    // print title
30    printf("\t\t Adjacency Matrix\n\n");
31
32    // print header of table, enclose charging stations with square brackets
33    printf("\t\t A B [C] [D] E F G H I \n\n");
34
35
36
37
38    // print new line
39    printf("\n");
40
41    // iterate from 0 to 8, for i is inside the boundary, execute block
42    // this is for printing rows
43    for (; i < ROWS; i++)
44    {
45        // since every row starts with a label, print label
46        // if i is equivalent to 2 or 3
47        if (i == 2 || i == 3)
48        {
49            // print label inside square brackets
50            printf("[%c] ", label[i]);
51        }
52        // else, i is equivalent to destinations
53        else
54        {
55            // print label
56            printf("%c ", label[i]);
57        }
58
59        // after printing the label in that row
60        // iterate through the column values in that row
61        // iterate from 0 to 8, for j is inside the column boundary, execute
62        for (int j = 0; j < COLS; j++)
63        {
64            // if value in that column of row equals to one,
65            if (road_networks[i][j] == 1)
66            {
67                // print value and spaces for organization
68                printf("1 ");
69            }
70            // else, value in that column of row equals to zero,
71            else
72            {
73                // print value and spaces for organization

```

```
C as7.c x
C:\Users\ACER> Downloads > C as7.c > main()
70 else
71 {
72     // print value and spaces for organization
73     printf("0 ");
74 }
75 // update value of j by 1, check if j value evaluates true from the
76 // if true, keep executing block and printing values
77 // otherwise, exit loop
78 }
79
80 // print new line after all values in every column of that row has been
81 printf("\n");
82
83 // update value of i by 1, check if i value evaluates true from the c -
84 // if true, proceed to the next row and print values
85 // otherwise exit loop
86 }
87
88 // print user prompt and instructions
89 printf("\n\nWhich point are you located? 0 - A, 1 - B, 2 - C, 3 - D, 4 -
90
91 // user prompt
92 printf("Location: ");
93
94 // store user input to loc variable (short for location)
95 scanf("%d", &loc);
96
97 // print equivalent of the user input integer to the value in label array
98 printf("\nAt point: %c", label[loc]);
99
100 // iterate through the rows of road_networks array
101 for (i = 0; i < ROWS; i++)
102 {
103     // if location is equivalent to 2,
104     if (loc == 2)
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Location: 0 At point: A C arrived to charging station.	Location: 1 At point: B C arrived to charging station.	
Location: 2 At point: C C is a charging station.	Location: 3 At point: D D is a charging station.	Location: 4 At point: E D arrived to charging station.
Location: 5 At point: F C arrived to charging station.		