

# NCERT Solutions for Class 12 Computer Science (C++) – Stack

## Short Answer Type Questions-II[2 marks each]

### Question 1.

Evaluate the following postfix expression. Show the status of stack after execution of each operation separately:

2,13, + , 5, -,6,3,/,5\*,<

### Answer:

--	--	--

ITEM SCANNED	OPERATION	STACK
2	PUSH 2	2
13	PUSH 13	2,13
+	POP 13 and 2 Evaluate $2 + 13 = 15$ PUSH 15	15
5	PUSH 5	15,5
-	POP 5 & 15 EVALUATE $15 - 5 = 10$ PUSH 10	10
6	PUSH 6	10,6
3	PUSH 3	10,6,3
/	POP 3 & 6 EVALUATE $6/3 = 2$ PUSH 2	10,2

5	PUSH 5	10, 2, 5
*	POP 5 & 2 EVALUATE $2*5 = 10$ PUSH 10	10, 10
<	POP 10 & 10 EVALUATE $10 < 10 = \text{FALSE}$ PUSH FALSE	FALSE

RESULT = FALSE

**Question 2.**

Evaluate the following postfix expression : (show status of Stack after each operation)

100,40,8,/,20,10,-,+,\*

**Answer:**

ITEM	OPERATION	STACK
SCANNED		

100	PUSH 100	100
40	PUSH 40	100,40
8	PUSH 8	100,40,8
/	POP 8 POP 40 EVALUATE $40/8 = 5$ PUSH 5	100,5
20	PUSH 20	100,5,20
10	PUSH 10	100, 5, 20, 10
	POP 10 POP 20 EVALUATE $20-10 = 10$ PUSH 10	100,5,10
+	POP 10 POP 5 EVALUATE $10 + 5 = 15$ PUSH 15	100,15
*	POP 15	1500

POP 100

EVALUATE  $100 * 15 = 1500$

PUSH 1500

### Question 3.

Evaluate the following postfix expression. Show the status of stack after execution of each operation separately:

T, F, NOT, AND, T, OR, F, AND

**Answer:**

S.No.	Scanned Element	Operation	Stack
1	True	PUSH True	True
2	False	PUSH False	False
3	NOT	POP False	True
	Calculate NOT False	PUSH True	True, True
4	And	POP True POP True	True
	calculate:	PUSH True	True

	True AND True		
5	True	PUSH True	True, True
6	OR	POP True	True
	Calculate: True OR True	PUSH True	True
7	False	PUSH False	True, False
8	AND	POP False	True
	Calculate: True AND False	POP True PUSH False	False

Thus the stack will have False Value

**Question 4.**

Evaluate the following postfix expression. Show the status of stack after execution of each operation separately:

F, T, NOT, AND, F, OR, T, AND

**Answer:**

--	--	--	--

S.No.	Scanned Element	Operation	Stack
1	F	PUSH F	F
2	T	PUSH T	F,T
3	NOT	POP T	F
	Calculate NOT T	PUSH F	F,F
4	AND	POP F	F
	Calculate NOT	POP F	F
		PUSH F	
5	F	PUSH F	F,F
6	OR	POP F	
		POP F	

7	T	PUSH T	F,T
8	AND	POP T POP F PUSH F	F F

Thus the stack will have False Value

**Question 5.**

Evaluate the following postfix expression using a stack and show the contents of stack after execution of each operation:

5,3,2, \*, 4,2, /, -, \*

**Answer:**

SYMBOL	STACK	OUTPUT
5		5
3		5,3
2		5,3,2



	PUSH 3,2	5
*	Perform $3*2=6$	5
	POP 6	5,6
4		5,6,4
2		5,6,4,2
/	PUSH 4,2	5,6
	Perform $4/2=2$	5,6
	POP 2	5,6,2
-	PUSH 6,2	5
	Perform $6-2=4$	5
	POP 4	5,4

*	PUSH 5,4  perform 5*4=20.  POP 20	20
---	---	----

Result=20

**Question 6.**

Evaluate the following POSTFIX notation. Show status of Stack after every step of evaluation (i.e. after each operation)

False NOT, True, AND, True, False, OR, AND

**Answer:**

Element Scanned	Stack Status
False	False
NOT	True
True	True, True
AND	True

True	True, True
False	True, True, False
OR	True, True
AND	True

Final Answer: True

### Question 7.

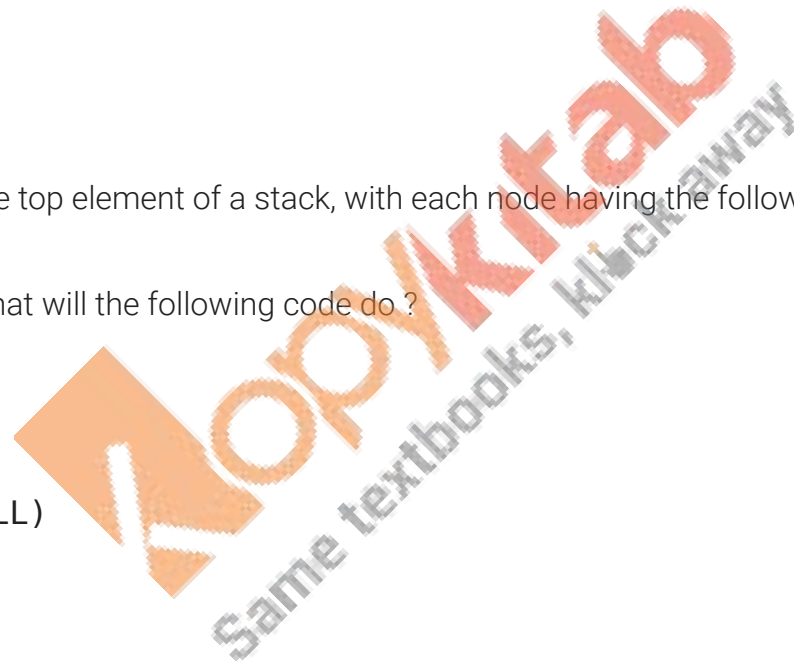
Top is a pointer variable pointing to the top element of a stack, with each node having the following structure declaration:

```
struct Stack {int Data, Stack * Next};
```

Considering the above explanation, what will the following code do ?

```
int count = 0, Sum = 0;
```

```
Stack * Temp = Top;  
while (Temp -> Next != NULL)  
{ count ++;  
Sum += Temp -> Data;  
Temp = Temp -> Next;  
}  
count << Sum / count;
```



**Answer:**

It will calculate the average of stack values.

**Question 8.**

Convert the expression  $((x * 3 + y * 3 + z * 3) / (x + y + z))$  into postfix expression. Show the content of the stack during the conversion.

**Answer:**

Given expression :  $((x * 3 + y * 3 + z * 3) / (x + y + z))$

$((x * 3 + y * 3 + z * 3) / (x + y + z))$

Symbol Scanned	Stack	Expression
(	(	-
(	((	-
X	((	X
*	((*	X
3	((*	x3

+

((\* +

x3

y

((\* +

x3y

X-

((\* + \*

x3y

3

((\* + \*

x3y3

+

((\* + \* +

x3y3

z

((\* + \* +

x3y3z

X-

((\* + \* + \*

x3y3z

3

((\* + \* + \*

x3y3z3

)

(

x3y3z3 \* + \* + \*

/

(/

x3y3z3 \* + \* + \*

(

((/

x3y3z3\* + \* + \*

X

((/

x3y3z3 \* + \* + \* x



+	(/(+	x3y3z3 * + * + * x •
y	(/(+	x3y3z3 * + * + * x y
+	</(+ +	x3y3z3 * + * + * x y
Z	(/(+ +	x3y3z3 * + * + * xyz
)	(/	x3y3z3 * + * + * xyz + +
)		x3y3z3 * + * + * xyz + +/

\Postfix expression is: x3y3z3 \* + \* + \* xyz + +/

**Question 9.**

Evaluate the following POSTFIX expression, show the status of Stack after execution of each operation separately:

45,45,+ ,32,20,10,/,-,\*

**Answer:**

Element Scanned	Stack Status
45	45

45	45,45
+	90
32	90,32
20	90,32,20
10	90,32,20,10
/	90,32,2
-	90,30
*	2700

Hence the final result is 2700

**Question 10.**

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion.

$$P/Q+(R-T)*U$$

**Answer:**

$$P/Q+(R-T)*U = (P/Q+(R-T)*U)$$

--	--	--

Element	Stack of Operator	Postfix Expression
(	(	
P	(	P
/	(/	P
Q	</	PQ
+	(/+	PQ
(	(/+(	PQ
R	(/+(	PQR
-	(/+(-	PQR
T	(/+(-	PQRT
)	(/+	PQRT-
*	(*	PQRT-+/*



U	)*	PQRT-+/U
)		PQRT-+/U*

## Short Answer Type Questions-II[3 marks each]

### Question 1.

Write the definition of a member function Pop () in C++, to delete a book from a dynamic stack of TEXTBOOKS considering the following code is already included in the program.

```
Struct TEXTBOOKS
```

```
{
Char ISBN [20]; Char TITLE [80]; TEXTBOOKS *Link;
};
```

```
class STACK
```

```
{
TEXTBOOKS *Top;
```

```
public :
```

```
STACK () {Top = NULL;}
```

```
void Push ();  
. void pop );  
-STACK ();  
};
```

**Answer:**

```
void STACK : : POP ()  
{  
if (Top != NULL)  
{  
TEXTBOOKS *Temp;  
Temp=Top;  
cout<< TOP- >ISBN<<Top-  
TITLE<<"deleted"<<endl;  
Top=Top-Link;  
delete Temp;  
}  
else  
cout<<"Stack Empty"<<endl;  
}
```

**OR**

Any other correct equivalent function definition



## Question 2.

Write the definition of a member function PUSH () in C++, to add a new book in a dynamic stack of BOOKS considering the following code is already included in the program :

```
struct BOOKS
{
    Char ISBN [20]; TITLE[80];
    BOOKS *Link;
};
class STACK
{
    BOOKS *Top;
public :
    STACK () {Top = NULL;}
    void PUSH ();
    void POP ();
    ~STACK ();
};
```

## Answer:

```
void STACK :: PUSH ()
{
    BOOKS *Temp;
    Temp=new BOOKS;
    gets (Temp->ISBN);
```



```

gets (Temp->TITLE);
Temp->Link =Top;
Top=Temp;
}

```

**OR**

Any other correct equivalent function definition

**Question 3.**

Convert the expression  $(A-5)*6+(10/B)/2$  to corresponding postfix expression. Also show the status of operator stack after each step.

**Answer:**

$((A-5)*6+(10/B)/2)$

Scanned Elements	Stack Status	Output
(	(	
(	((	
A	((	
-	((-	A

5

)

\*

6

+

(

10

/

B

)

/

2

((-

(

(\*

(\*

(+

(+(

(+(

(+(/

(+(/

(+

(+(/

(+(/

A

A, 5

A, 5,-

A, 5,-

A, 5,-, 6

A, 5,-, 6\*

A, 5,-, 6,\*

A, 5, 6, \*, 10

A, 5,-, 6, \*, 10

A, 5, 6, \*, 10, B

A, 5,-, 6,10, B/

A, 5, 6,10, B J



)	A, 5, -, 6, *, 10, B, /, 2
	A, 5, -, 6, M0, B, y, 2, y, +

The correspondence postfix expression is A, 5, 6, 10, B, /, 2, /, +

## Long Answer Type Questions [4 marks each]

### Question 1.

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion.

$A/(B+C)*D-E$

### Answer:

$A/(B + C) *D-E$

Element	Stack	Expression
A	(	A
/	(/	A
(	(/C	A

B	(/c	AB
+	(/c+	AB
C	(/c+	ABC
)	(*	ABC+
★	(*	ABC+/ /
D	(-	ABC+/D
-	(-	ABC+/D*
E		ABC+/D*E-

**Question 2.**

Write definition for a function DISPMID (int A[][5], int R, int C) in C++ to display the elements of middle row and middle column from a two dimensional array A having R number of rows and C number of columns.

For example, if the content of array is as follows:

--	--	--	--	--

215	912	516	401	515
103	901	921	802	601
285	209	609	360	172

The function should display the following as output:

103 901 921 802

601 516 921 609

**Answer:**

```
void DISPMID (int A[] [5] , int R, int C)
{
    int mid = (R+C)/2;
    for (int i=0; i<c; i++)
    {
        Cout << A[mid] [i]<<" ";
    } cout<<endl;
    for (int i=0; i<R; i++)
        cout << A[i][mid]<<" ";
    }
}
```

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### Question 3.

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion.

$P/(Q-R)*S+T$



**Answer:**

$P/(Q-R)*S+T$

BODMAS : PQR-/S\*T+

PQR-/S\*T+

Element	Stack	Expression
P	(	P
/	(/	P
(	(/c	P
Q	(/c	PQ
-	(/c-	PQ
R	(/c-	PQR
)	(/	PQR-
*	(*	PQR-/

S	(*	PQR-/S
+	(+	PQR-/S*
T	(+	PQR-/S*T
)		PQR-/S*T+

**Question 4.**

Convert the following infix expression to its equivalent postfix expression, showing the stack contents for each step of conversion:

$X/Y+U*(V-W)$

**Answer:**

$$X / Y + U * (V - W) = ((X / Y) + (U * (V - W)))$$

Element	Stack	Postfix
(		
(		
X		X
/	/	X

Y	/	XY
)		XY/
+	+	XY/
(	+	XY/
U	+	XY/U
*	+*	XY/U
(	+*	XY/U
V	+*	XY/UV
-	+*	XY/UV
W	+*-	XY/UVW
)	+*	XY/UVW-
)	+	XY/UVW-*
)	it	XY/UVW-* +

OR

Element	Stack	Postfix
X		X
/	/	X
Y	/	XY
+	+	XY/
U	+	XY/U
*	+*	XY/U
(	+*(	XY/U
V	+*(	XY/UV
-	+*(-	XY/UV
w	+*(-	XY/UVW
)	+*	XY/UVW-

		XY/UW-*
		XY/UVW-* +

**OR**

Any other method or converting the given Infix expression to its equivalent Postfix expression showing stack contents

**Question 5.**

Evaluate the following postfix expression using stack and show the contents after execution of each.

**Answer:**

Operations : 470,5,4,∧,25,/,6,\*

S. No.	Symbol	Operation	Stack	Result
1	470	push(470)	470	
2	5	push(5)	470,5	
3	4	push(4)	470,5,4	
4	/N	P°P(4)	470,5	
0		pop(5)	470	

		perform(5^4)		
		push(625)	470,625	
5	25	push(25)	470,625,25	
6	/	pop(25)	470,625	
		pop(625)	470	
		perform(625/25)	470	
		push(25)	470,25	
7	6	push(6)	470,25,6	
8	*	pop(6)	470,25	
		pop(25)	470	
		perform(25*6)	470	

### Question 6.

Write member functions to perform POP and PUSH operations in a dynamically allocated stack containing the objects of the following structure:

```
struct Game
{ char Gamename[30];
  int numofplayer;
  Game *next; } ;
```

**Answer:**

```
struct Game
{
  char Gamename[30] ;
  int numofplayer;
  Game *next;
};
class Stack { Game *Top;
public :
  Stack ()
  {
    Top = NULL;
  }
  void Push();
  void Pop();
  void display();
  ~Stack();
} ;
void Stack::Push()
{
```



```

Game *temp = new Game;
cout<<"Enter Data : "; gets(temp->Gamename);
cin>>temp->numofplayer;
temp->next =Top;
Top = temp;
}
void Stack:: Pop()
{
if ( Top != NULL)
{
Game *temp = Top;
cout<<Gamename<<" Deleted"; Top = Top->next;
delete temp;
}
else
cout<<"Stack is empty....";
}

```

### Question 7.

Write a function PUSHBOOK() in C++ to perform insert operation on Dynamic Stack, which contains Book\_no and Book\_Title. Consider the following definition of NODE, while writing your C++ code,

```

struct NODE
{
int Book_No ;
char Book_Title [20];

```



```
NODE * Next;  
};
```

**Answer:**

```
Void PUSHBOOK (NODE *TOP> int Book_No, char B Title [20])  
{  
NODE*temp;  
temp=new NODE;  
temp -> Book_No=Book_No;  
Strcpy (temp -> Book_Title, B Title) ;  
temp --> Next=NULL ;  
if (Top==NULL)  
Top=temp;  
else  
{  
temp -> Next=top;  
Top==temp;  
}  
}
```

**Question 8.**

Write a function POPBOOK() in C++ to perform delete operation from a Dynamic Stack, which contains Bno and Title. Consider the following definition of NODE, while writing your C++code.



```
struct NODE
{
int Bno;
char Title[20] ;
NODE * Link;
} ;
```

**Answer:**

```
node*PopB00K(node*TOP int Bno, char B Title [20])
{
node*temp;
temp=new node;
temp ->Bno=Bno;
strcpy (temp ->Title, B Title);
temp ->link=NULL;
if (TOP==NULL)
Top=Temp;
else
{
temp ->link=Top;
TOP==temp;
}
}
```



### Question 9.

Write the definition of a member function push() for a class Library in C++ to insert a book information in a dynamically allocated stack of books considering the following code is already written as a part of the program

```
struct book
{
int bookid;
char bookname[20];
book*next;
} ;
class Library
{
book*top;
public
Library()
{
top=NULL;
}
void push();
void pop();
void disp() ;
~Library();
};
```

**Answer:**



```

void Library: :push()
{
book*nptr;
nptr=new book;
cout<<"Enter values for bookid and bookname"; cin> >nptr->bookid;
gets(nptr->bookname);
nptr->next =NULL;
if (top==NULL)
top=nptr;
else
{
nptr->next=top,
top=nptr;
}
}

```

**Question 10.**

Convert the following Infix expression to its equivalent Postfix expression, showing the stack contents for each step of conversion:

$U * V + R / (S - T)$

**Answer:**

$U * V + R / (S - T)$

Element	Stack	Postfix
(		

(		
U		U
*	*	
V		UV
)		UV*
+	+	
(		
R		UV*R
/	+/	
(		
S		UV*RS
-	+/-	
T		UV*RST
)		UV*RST-



)		UV*RST-/
)		UV*RST-/+

**OR**

U		U
*	*	U
V	*	UV
+	+	UV*
R	+	UV*R
/	+/	UV*R
(	+/	UV*R
S	+/	UV*RS
-	+/(-	UV*RS
T	+/(-	UV*RST

)	+/	UV'RST-
	+	UV'RST-/
		UV*RST-/+

**OR**

Any other method for converting the given Infix expression to its equivalent Postfix expression showing stack contents.

