

# Stack Usage Example

## ECE2036

September 4, 2012

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     PC → Sub0(1, 2);
25 }
```

Stack Memory

SP →

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

PC →

SP →

Addr of Line 25  
Sub0::i = 1  
Sub0::j = 2

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

PC →

Stack Memory

SP →

```
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16 PC → char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

```
SP →
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17 PC → Sub1(i);
18       Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

SP →

```
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8 PC →   int k1 = 5;
9         Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

## Stack Memory

SP →

```
Addr of Line 18
Sub1::j = 1
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9 PC →   Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

## Stack Memory

SP →

```
Sub1::k1 = 5
Addr of Line 18
Sub1::j = 1
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```



# Stack Usage Example

```
1      void Sub2(int k)
2      {
3  PC →   k = 4;
4      }
5
6      void Sub1(int j)
7      {
8          int k1 = 5;
9          Sub2(k1);
10     }
11
12     void Sub0(int i,int j)
13     {
14         int d[4];
15         int x;
16         char ch[]="Test";
17         Sub1(i);
18         Sub2(j);
19     }
20
21
22     int main()
23     {
24         Sub0(1, 2);
25     }
```

## Stack Memory

SP →

```
Addr of Line 10
Sub2::k = 5
Sub1::k1 = 5
Addr of Line 18
Sub1::j = 1
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3   k = 4;
4 PC → }
5
6 void Sub1(int j)
7 {
8   int k1 = 5;
9   Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14   int d[4];
15   int x;
16   char ch[]="Test";
17   Sub1(i);
18   Sub2(j);
19 }
20
21
22 int main()
23 {
24   Sub0(1, 2);
25 }
```

## Stack Memory

SP →

```
Addr of Line 10
Sub2::k = 4
Sub1::k1 = 5
Addr of Line 18
Sub1::j = 1
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 PC → }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

SP →

```
Sub1::k1 = 5
Addr of Line 18
Sub1::j = 1
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

SP →

```
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1      void Sub2(int k)
2      {
3  PC →   k = 4;
4      }
5
6      void Sub1(int j)
7      {
8          int k1 = 5;
9          Sub2(k1);
10     }
11
12     void Sub0(int i,int j)
13     {
14         int d[4];
15         int x;
16         char ch[]="Test";
17         Sub1(i);
18         Sub2(j);
19     }
20
21
22     int main()
23     {
24         Sub0(1, 2);
25     }
```

Stack Memory

SP →

```
Addr of Line 19
Sub2::k = 2
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1      void Sub2(int k)
2      {
3          k = 4;
4  PC → }
5
6      void Sub1(int j)
7      {
8          int k1 = 5;
9          Sub2(k1);
10     }
11
12     void Sub0(int i,int j)
13     {
14         int d[4];
15         int x;
16         char ch[]="Test";
17         Sub1(i);
18         Sub2(j);
19     }
20
21
22     int main()
23     {
24         Sub0(1, 2);
25     }
```

Stack Memory

SP →

```
Addr of Line 19
Sub2::k = 4
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 PC → }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 }
```

Stack Memory

SP →

```
Sub0::ch[0] = 'T'
Sub0::ch[1] = 'e'
Sub0::ch[2] = 's'
Sub0::ch[3] = 't'
Sub0::ch[4] = 0
Sub0::x = ?
Sub0::d[0] = ?
Sub0::d[1] = ?
Sub0::d[2] = ?
Sub0::d[3] = ?
Addr of Line 25
Sub0::i = 1
Sub0::j = 2
```

# Stack Usage Example

```
1 void Sub2(int k)
2 {
3     k = 4;
4 }
5
6 void Sub1(int j)
7 {
8     int k1 = 5;
9     Sub2(k1);
10 }
11
12 void Sub0(int i,int j)
13 {
14     int d[4];
15     int x;
16     char ch[]="Test";
17     Sub1(i);
18     Sub2(j);
19 }
20
21
22 int main()
23 {
24     Sub0(1, 2);
25 PC → }
```

Stack Memory

SP →











## Stack Usage Example (more realistic)

```
1      void Sub2(int k)                Stack Memory
2      {
3          k = 4;
4      }
5
6      void Sub1(int j)                ?
7      {
8          int k1 = 5;                 ?
9          Sub2(k1);                   ?
10     }
11
12     void Sub0(int i,int j)          SP → ?
13     {
14         int d[4];                   Sub0::ch[0] = 'T'
15         int x;                      Sub0::ch[1] = 'e'
16         char ch[]="Test";           Sub0::ch[2] = 's'
17     PC → Sub1(i);                  Sub0::ch[3] = 't'
18         Sub2(j);                   Sub0::ch[4] = 0
19     }                               Sub0::x = ?
20
21                                     Sub0::d[0] = ?
22     int main()                     Sub0::d[1] = ?
23     {                               Sub0::d[2] = ?
24         Sub0(1, 2);                Sub0::d[3] = ?
25     }                               Addr of Line 25
                                     Sub0::i = 1
                                     Sub0::j = 2
```

## Stack Usage Example (more realistic)

```
1      void Sub2(int k)                Stack Memory
2      {
3          k = 4;
4      }
5
6      void Sub1(int j)                ?
7      {                               ?
8  PC →   int k1 = 5;                 ?
9          Sub2(k1);                 ?
10      }                               ?
11
12     void Sub0(int i,int j)           Addr of Line 18
13     {                               Sub1::j = 1
14         int d[4];                   Sub0::ch[0] = 'T'
15         int x;                       Sub0::ch[1] = 'e'
16         char ch[]="Test";           Sub0::ch[2] = 's'
17         Sub1(i);                     Sub0::ch[3] = 't'
18         Sub2(j);                     Sub0::ch[4] = 0
19     }                               Sub0::x = ?
20
21                                     Sub0::d[0] = ?
22     int main()                       Sub0::d[1] = ?
23     {                               Sub0::d[2] = ?
24         Sub0(1, 2);                 Sub0::d[3] = ?
25     }                               Addr of Line 25
                                     Sub0::i = 1
                                     Sub0::j = 2
```

## Stack Usage Example (more realistic)

```
1      void Sub2(int k)                Stack Memory
2      {
3          k = 4;
4      }
5
6      void Sub1(int j)                ?
7      {
8          int k1 = 5;                 ?
9  PC →  Sub2(k1);                     SP →  ?
10     }
11
12     void Sub0(int i,int j)           Sub1::k1 = 5
13     {                                Addr of Line 18
14         int d[4];                   Sub1::j = 1
15         int x;                       Sub0::ch[0] = 'T'
16         char ch[]="Test";           Sub0::ch[1] = 'e'
17         Sub1(i);                     Sub0::ch[2] = 's'
18         Sub2(j);                     Sub0::ch[3] = 't'
19     }                                Sub0::ch[4] = 0
20                                     Sub0::x = ?
21                                     Sub0::d[0] = ?
22     int main()                       Sub0::d[1] = ?
23     {                                Sub0::d[2] = ?
24         Sub0(1, 2);                  Sub0::d[3] = ?
25     }                                Addr of Line 25
                                       Sub0::i = 1
                                       Sub0::j = 2
```

## Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	?
3	PC → k = 4;	?
4	}	?
5		
6	void Sub1(int j)	SP → ?
7	{	Addr of Line 10
8	int k1 = 5;	Sub2::k = 5
9	Sub2(k1);	Sub1::k1 = 5
10	}	Addr of Line 18
11		Sub1::j = 1
12	void Sub0(int i,int j)	Sub0::ch[0] = 'T'
13	{	Sub0::ch[1] = 'e'
14	int d[4];	Sub0::ch[2] = 's'
15	int x;	Sub0::ch[3] = 't'
16	char ch[]="Test";	Sub0::ch[4] = 0
17	Sub1(i);	Sub0::x = ?
18	Sub2(j);	Sub0::d[0] = ?
19	}	Sub0::d[1] = ?
20		Sub0::d[2] = ?
21		Sub0::d[3] = ?
22	int main()	Addr of Line 25
23	{	Sub0::i = 1
24	Sub0(1, 2);	Sub0::j = 2
25	}	



## Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	?
3	k = 4;	?
4	PC → }	?
5		
6	void Sub1(int j)	SP → ?
7	{	Addr of Line 10
8	int k1 = 5;	Sub2::k = 4
9	Sub2(k1);	Sub1::k1 = 5
10	}	Addr of Line 18
11		Sub1::j = 1
12	void Sub0(int i,int j)	Sub0::ch[0] = 'T'
13	{	Sub0::ch[1] = 'e'
14	int d[4];	Sub0::ch[2] = 's'
15	int x;	Sub0::ch[3] = 't'
16	char ch[]="Test";	Sub0::ch[4] = 0
17	Sub1(i);	Sub0::x = ?
18	Sub2(j);	Sub0::d[0] = ?
19	}	Sub0::d[1] = ?
20		Sub0::d[2] = ?
21		Sub0::d[3] = ?
22	int main()	Addr of Line 25
23	{	Sub0::i = 1
24	Sub0(1, 2);	Sub0::j = 2
25	}	

# Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	
3	k = 4;	
4	}	
5		?
6	void Sub1(int j)	?
7	{	?
8	int k1 = 5;	Addr of Line 10
9	Sub2(k1);	SP → Sub2::k = 4
10	PC → }	Sub1::k1 = 5
11		Addr of Line 18
12	void Sub0(int i,int j)	Sub1::j = 1
13	{	Sub0::ch[0] = 'T'
14	int d[4];	Sub0::ch[1] = 'e'
15	int x;	Sub0::ch[2] = 's'
16	char ch[]="Test";	Sub0::ch[3] = 't'
17	Sub1(i);	Sub0::ch[4] = 0
18	Sub2(j);	Sub0::x = ?
19	}	Sub0::d[0] = ?
21		Sub0::d[1] = ?
22	int main()	Sub0::d[2] = ?
23	{	Sub0::d[3] = ?
24	Sub0(1, 2);	Addr of Line 25
25	}	Sub0::i = 1
		Sub0::j = 2

## Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	
3	k = 4;	
4	}	
5		?
6	void Sub1(int j)	?
7	{	?
8	int k1 = 5;	Addr of Line 10
9	Sub2(k1);	Sub2::k = 4
10	}	Sub1::k1 = 5
11		Addr of Line 18
12	void Sub0(int i,int j)	SP → Sub1::j = 1
13	{	Sub0::ch[0] = 'T'
14	int d[4];	Sub0::ch[1] = 'e'
15	int x;	Sub0::ch[2] = 's'
16	char ch[]="Test";	Sub0::ch[3] = 't'
17	Sub1(i);	Sub0::ch[4] = 0
18	PC → Sub2(j);	Sub0::x = ?
19	}	Sub0::d[0] = ?
20		Sub0::d[1] = ?
21		Sub0::d[2] = ?
22	int main()	Sub0::d[3] = ?
23	{	Addr of Line 25
24	Sub0(1, 2);	Sub0::i = 1
25	}	Sub0::j = 2

## Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	
3	PC → k = 4;	
4	}	
5		?
6	void Sub1(int j)	?
7	{	?
8	int k1 = 5;	Addr of Line 10
9	Sub2(k1);	Sub2::k = 4
10	}	SP → Sub1::k1 = 5
11		Addr of Line 19
12	void Sub0(int i,int j)	Sub2::k = 2
13	{	Sub0::ch[0] = 'T'
14	int d[4];	Sub0::ch[1] = 'e'
15	int x;	Sub0::ch[2] = 's'
16	char ch[]="Test";	Sub0::ch[3] = 't'
17	Sub1(i);	Sub0::ch[4] = 0
18	Sub2(j);	Sub0::x = ?
19	}	Sub0::d[0] = ?
21		Sub0::d[1] = ?
22	int main()	Sub0::d[2] = ?
23	{	Sub0::d[3] = ?
24	Sub0(1, 2);	Addr of Line 25
25	}	Sub0::i = 1
		Sub0::j = 2

## Stack Usage Example (more realistic)

1	void Sub2(int k)	Stack Memory
2	{	
3	k = 4;	
4	PC → }	
5		?
6	void Sub1(int j)	?
7	{	?
8	int k1 = 5;	Addr of Line 10
9	Sub2(k1);	Sub2::k = 4
10	}	SP → Sub1::k1 = 5
11		Addr of Line 19
12	void Sub0(int i,int j)	Sub2::k = 4
13	{	Sub0::ch[0] = 'T'
14	int d[4];	Sub0::ch[1] = 'e'
15	int x;	Sub0::ch[2] = 's'
16	char ch[]="Test";	Sub0::ch[3] = 't'
17	Sub1(i);	Sub0::ch[4] = 0
18	Sub2(j);	Sub0::x = ?
19	}	Sub0::d[0] = ?
21		Sub0::d[1] = ?
22	int main()	Sub0::d[2] = ?
23	{	Sub0::d[3] = ?
24	Sub0(1, 2);	Addr of Line 25
25	}	Sub0::i = 1
		Sub0::j = 2

## Stack Usage Example (more realistic)

```
1      void Sub2(int k)                Stack Memory
2      {
3          k = 4;
4      }
5
6      void Sub1(int j)                ?
7      {
8          int k1 = 5;                 ?
9          Sub2(k1);                   ?
10     }
11
12     void Sub0(int i,int j)           SP → Addr of Line 10
13     {
14         int d[4];                    Sub2::k = 4
15         int x;                       Sub1::k1 = 5
16         char ch[]="Test";            Addr of Line 19
17         Sub1(i);                     Sub2::k = 4
18         Sub2(j);                     Sub0::ch[0] = 'T'
19     }                                 Sub0::ch[1] = 'e'
20                                     Sub0::ch[2] = 's'
21                                     Sub0::ch[3] = 't'
22                                     Sub0::ch[4] = 0
23                                     Sub0::x = ?
24                                     Sub0::d[0] = ?
25                                     Sub0::d[1] = ?
26                                     Sub0::d[2] = ?
27                                     Sub0::d[3] = ?
28                                     Addr of Line 25
29                                     Sub0::i = 1
30                                     Sub0::j = 2
31
32     int main()
33     {
34         Sub0(1, 2);
35     }
```

## Stack Usage Example (more realistic)

```
1      void Sub2(int k)                Stack Memory
2      {
3          k = 4;
4      }
5
6      void Sub1(int j)                ?
7      {
8          int k1 = 5;                 ?
9          Sub2(k1);                   ?
10     }
11
12     void Sub0(int i,int j)           Addr of Line 10
13     {
14         int d[4];                   Sub2::k = 4
15         int x;                       Sub1::k1 = 5
16         char ch[]="Test";           Addr of Line 19
17         Sub1(i);                     Sub2::k = 4
18         Sub2(j);                     Sub0::ch[0] = 'T'
19     }                                 Sub0::ch[1] = 'e'
20                                     Sub0::ch[2] = 's'
21                                     Sub0::ch[3] = 't'
22                                     Sub0::ch[4] = 0
23                                     Sub0::x = ?
24                                     Sub0::d[0] = ?
25                                     Sub0::d[1] = ?
26                                     Sub0::d[2] = ?
27                                     Sub0::d[3] = ?
28                                     Addr of Line 25
29                                     Sub0::i = 1
30                                     Sub0::j = 2
31
32     int main()
33     {
34         Sub0(1, 2);
35     }
36
37 PC →
```