List of programs:-

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Matrix Addition

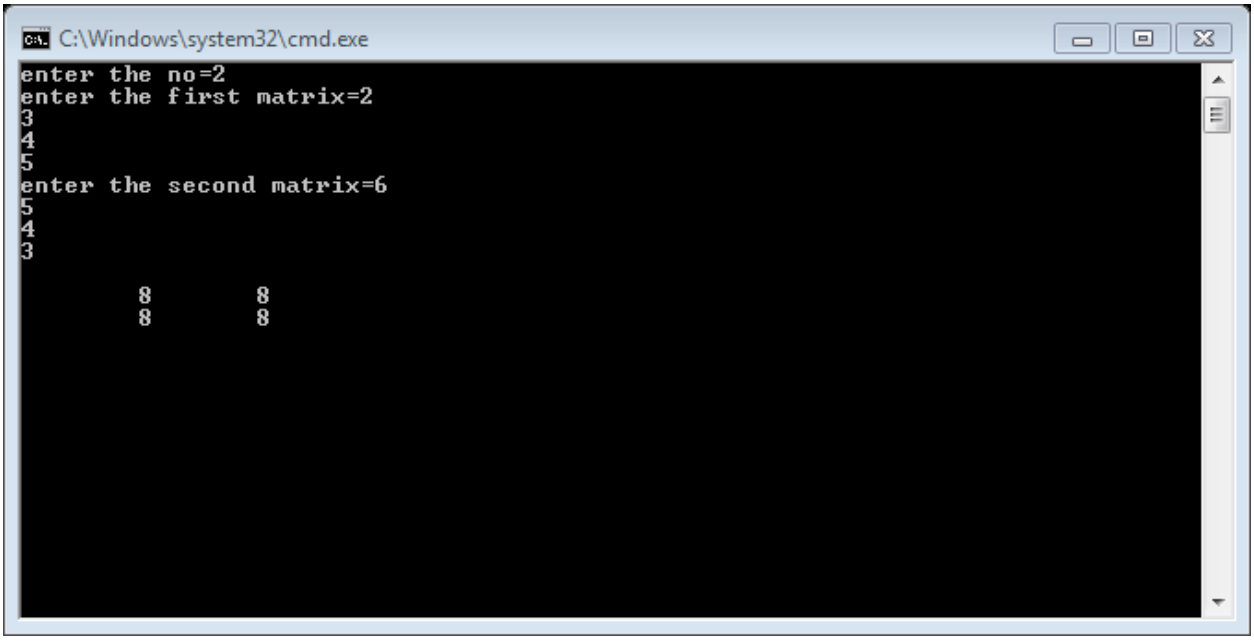
single block without shared memory, single block with shared memory
multiple block without shared memory, multiple block with shared memory

/* single block without shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void addition(int* a,int* b,int* c,int n)
{
int h;
h=a[threadIdx.x+n*threadIdx.y]+b[threadIdx.x+n*threadIdx.y];

c[threadIdx.x+n*threadIdx.y]=h;

}
 main()
{
int *a_h,*b_h,*c_h,*a_d,*b_d,*c_d;
int i,n,z;
printf("enter the no=");
```

```
scanf("%d",&n);
z=n*n;
size_t size=sizeof(int)*z;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
c_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
cudaMalloc((void**)&c_d,size);
printf("enter the first matrix=");
for(i=0;i<z;i++)
{
scanf("%d",&a_h[i]);
}
printf("enter the second matrix=");
for(i=0;i<z;i++)
{
scanf("%d",&b_h[i]);
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
cudaMemcpy(b_d,b_h,size,cudaMemcpyHostToDevice);
dim3 dimBlock(n,n,1);
dim3 dimGrid(1,1);
addition<<<dimGrid,dimBlock>>>(a_d,b_d,c_d,n);
cudaMemcpy(c_h,c_d,size,cudaMemcpyDeviceToHost);
for(i=0;i<z;i++)
{
if(i%n==0)
{
printf("\n");
}
printf("%d",c_h[i]);
}
free(a_h);
free(b_h);
free(c_h);
cudaFree(a_d);
cudaFree(b_d);
cudaFree(c_d);
getch();
}
```

Output :-

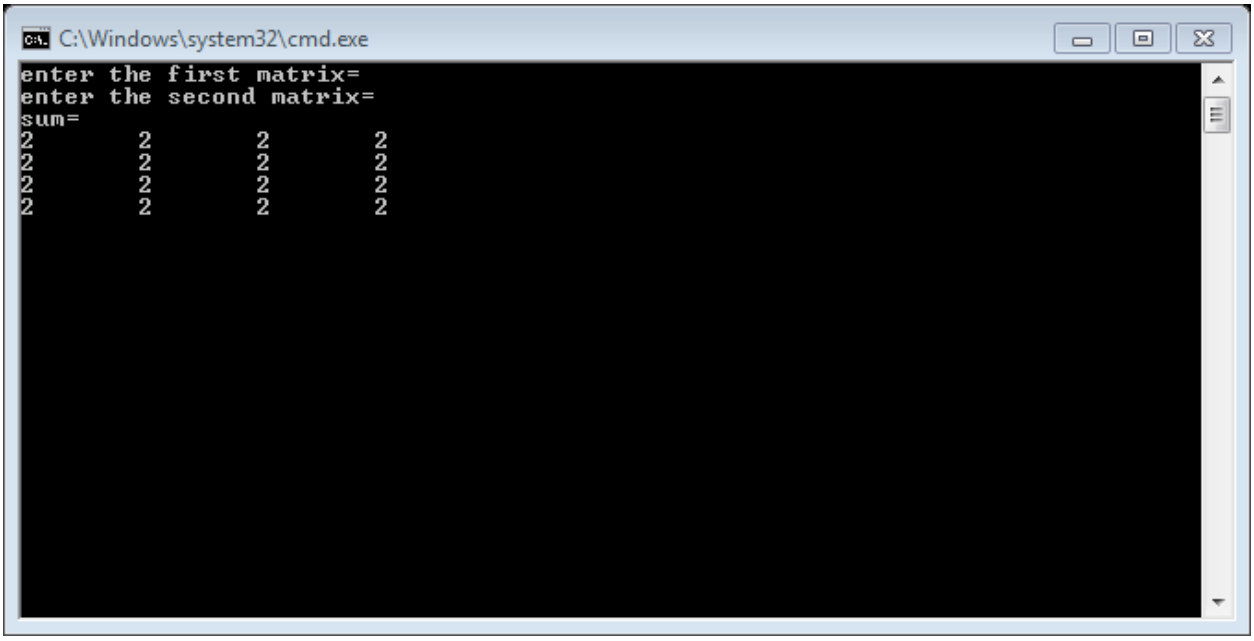


/* multiple block without shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void addition(int* a,int* b,int* c,int n)
{
int h;
int x=blockIdx.x*2+threadIdx.x;
int y=blockIdx.y*2+threadIdx.y;
h=a[x+n*y]+b[x+n*y];

c[x+n*y]=h;

}
 main()
{
int *a_h,*b_h,*c_h,*a_d,*b_d,*c_d;
int i,n=4,z;

z=n*n;
size_t size=sizeof(int)*z;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
```

```
c_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
cudaMalloc((void**)&c_d,size);
printf("enter the first matrix=");
for(i=0;i<z;i++)
{
a_h[i]=1;
}
printf("\nenter the second matrix=");
for(i=0;i<z;i++)
{
b_h[i]=1;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
cudaMemcpy(b_d,b_h,size,cudaMemcpyHostToDevice);
dim3 dimBlock(2,2,1);
dim3 dimGrid(2,2);
addition<<<dimGrid,dimBlock>>>(a_d,b_d,c_d,n);
cudaMemcpy(c_h,c_d,size,cudaMemcpyDeviceToHost);
printf("\nsum=");
for(i=0;i<z;i++)
{
if(i%n==0)
{
printf("\n");
}
printf("%d\t",c_h[i]);
}
free(a_h);
free(b_h);
free(c_h);
cudaFree(a_d);
cudaFree(b_d);
cudaFree(c_d);
getch();
}
```

Output:-

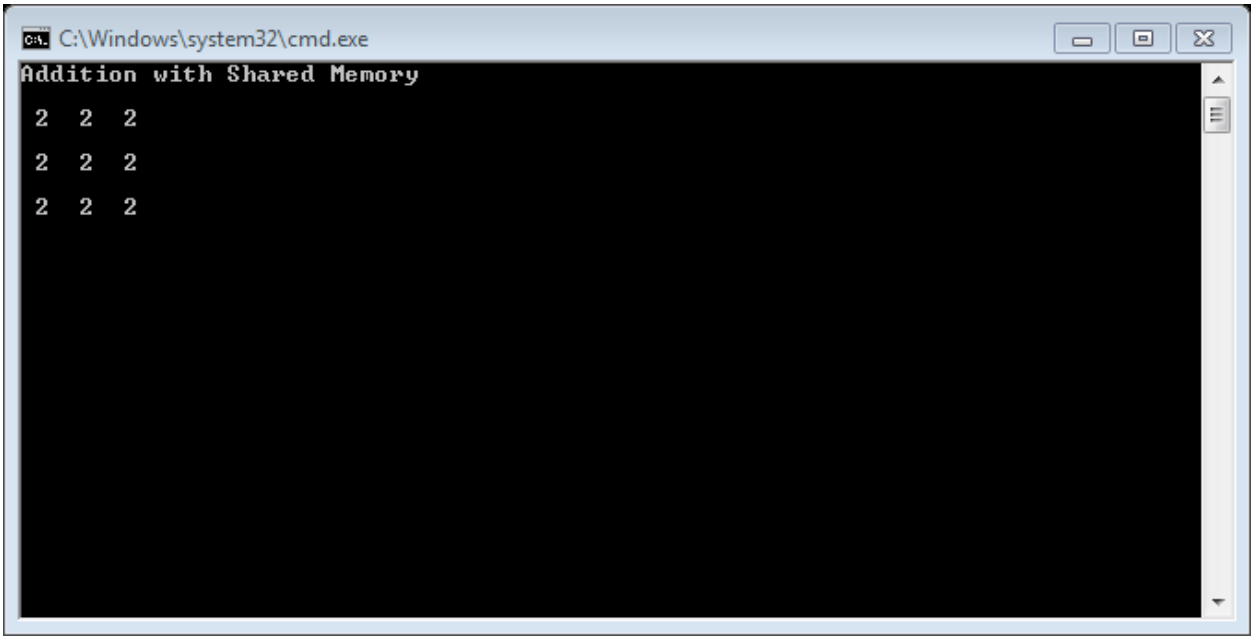


/* single block with shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void Sharesum(int* a,int* b,int* c,int n)
{
        __shared__ int as[3][3],bs[3][3];
        int s,k,i,sum=0;
        int tx,ty,bx,by;
        tx=threadIdx.x;
        ty=threadIdx.y;
        as[ty][tx]=a[tx+n*ty];
        bs[ty][tx]=b[tx+n*ty];
        sum += as[ty][tx]+bs[ty][tx];
        c[tx*n+ty]=sum;
}
main()
{
        int *ah,*ad,*bh,*bd,*ch,*cd;
        int i,n=3,z;
        z=n*n;
        size_t size=sizeof(int)*z;
```

```
	ah=(int*)malloc(size);
	bh=(int*)malloc(size);
	ch=(int*)malloc(size);
	cudaMalloc((void**)&ad,size);
	cudaMalloc((void**)&bd,size);
	cudaMalloc((void**)&cd,size);
	for(i=0;i<z;i++)
	{
		ah[i]=1;
	}
	for(i=0;i<z;i++)
	{
		bh[i]=1;
	}
	cudaMemcpy(ad,ah,size,cudaMemcpyHostToDevice);
	cudaMemcpy(bd,bh,size,cudaMemcpyHostToDevice);
	dim3 Block(n,n,1);
	dim3 Grid(1,1);
	Sharesum<<<Grid,Block>>>(ad,bd,cd,n);
	cudaMemcpy(ch,cd,size,cudaMemcpyDeviceToHost);
	printf("Addition with Shared Memory");
	for(i=0;i<z;i++)
	{
		if(i%n==0)
		{
			printf("\n\n");
		}
			printf(" %d ",cd[i]);
	}
	printf("\n");
	free(ah);
	free(bh);
	free(ch);
	cudaFree(ad);
	cudaFree(bd);
	cudaFree(cd);
	getch();
}
```

Output:-

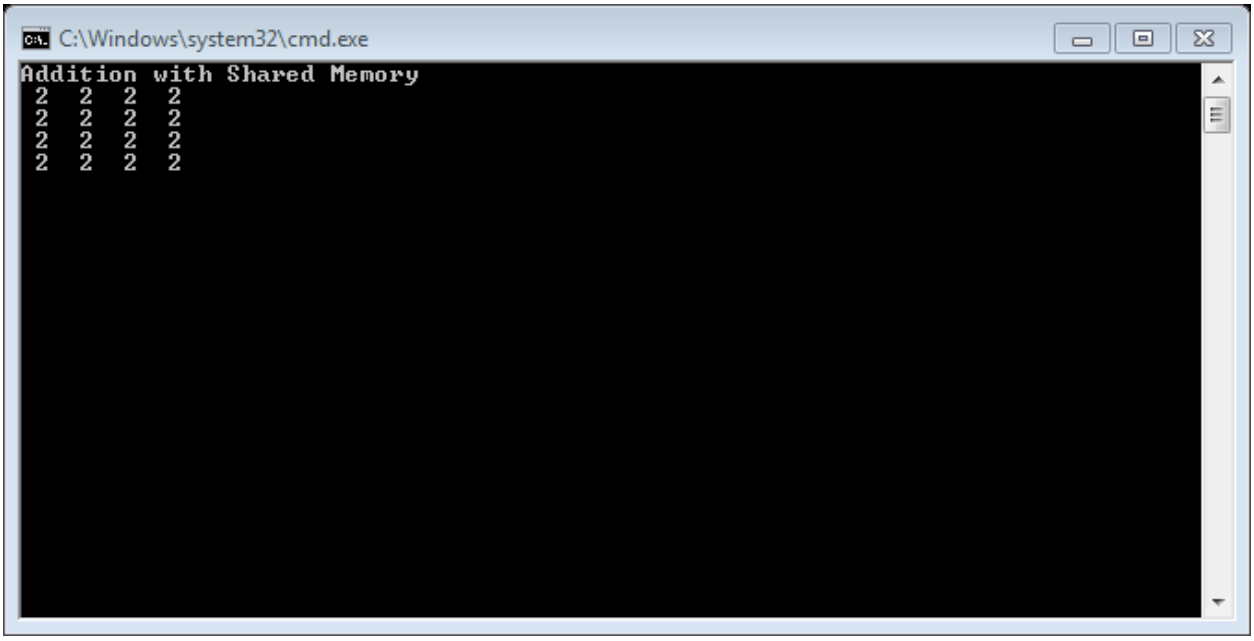


/* multiple block with shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void Sharesum(int* a,int* b,int* c,int n)
{
        __shared__ int as[8][8],bs[8][8];
        int s,k,i,sum=0;
        int tx,ty,bx,by;
        bx=blockIdx.x;
        by=blockIdx.y;
        tx=threadIdx.x;
        ty=threadIdx.y;
        s=bx*8+tx;
        k=by*8+ty;
        as[ty][tx]=a[k*n+tx];
        bs[ty][tx]=b[s+ty*n];
        sum += as[ty][tx]+bs[ty][tx];
        c[s*n+k]=sum;
}
main()
{
        int *ah,*ad,*bh,*bd,*ch,*cd;
        int i,n=32,z;
```

```
	z=n*n;
	size_t size=sizeof(int)*z;
	ah=(int*)malloc(size);
	bh=(int*)malloc(size);
	ch=(int*)malloc(size);
	cudaMalloc((void**)&ad,size);
	cudaMalloc((void**)&bd,size);
	cudaMalloc((void**)&cd,size);
	for(i=0;i<z;i++)
	{
		ah[i]=1;
	}
	for(i=0;i<z;i++)
	{
		bh[i]=1;
	}
	cudaMemcpy(ad,ah,size,cudaMemcpyHostToDevice);
	cudaMemcpy(bd,bh,size,cudaMemcpyHostToDevice);
	dim3 Block(8,8,1);
	dim3 Grid(4,4);
	Sharesum<<<Grid,Block>>>(ad,bd,cd,n);
	cudaMemcpy(ch,cd,size,cudaMemcpyDeviceToHost);
	printf("Addition with Shared Memory");
	for(i=0;i<z;i++)
	{
		if(i%n==0)
		{
			printf("\n\n");
		}
			printf(" %d ",cd[i]);
	}
	printf("\n");
	free(ah);
	free(bh);
	free(ch);
	cudaFree(ad);
	cudaFree(bd);
	cudaFree(cd);
	getch();
}
```

Output:-



2- Matrix Multiplication

single block without shared memory, single block with shared memory
multiple block without shared memory, multiple block with shared memory

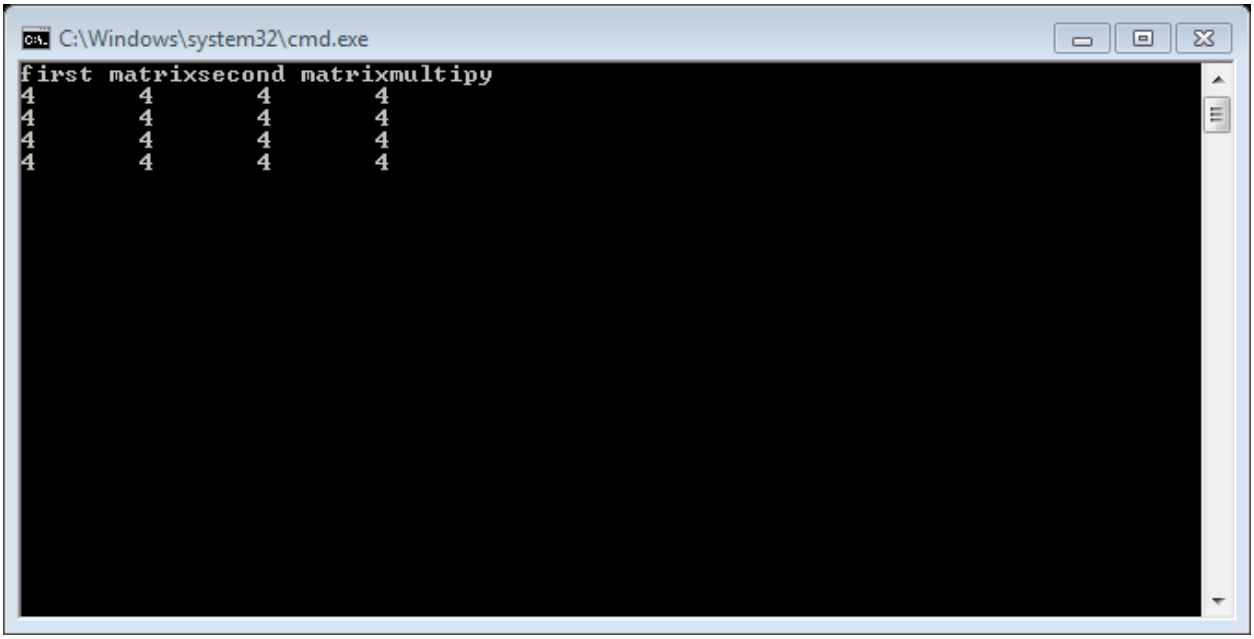
/* single block without shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>

__global__ void mul(int* a,int* b,int* c,int n)
{
__shared__ int as[4][4],bs[4][4];
int tx=threadIdx.x;
int ty=threadIdx.y;
int multi=0;
for(int k=0;k<n;k++)
        {
                as[ty][tx]=a[ty*n+k];
                bs[ty][tx]=b[tx+n*k];
                multi +=as[ty][tx]*bs[ty][tx];
        }
        c[ty*n+tx]=multi;
}
main()
{
```

```
int *a_h,*b_h,*c_h,*a_d,*b_d,*c_d;
int i,n=4,z;
z=n*n;
size_t size=sizeof(int)*z;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
c_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
cudaMalloc((void**)&c_d,size);
printf("first matrix");
for(i=0;i<z;i++)
{
a_h[i]=1;
}
printf("second matrix");
for(i=0;i<z;i++)
{
b_h[i]=1;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
cudaMemcpy(b_d,b_h,size,cudaMemcpyHostToDevice);
dim3 dimBlock(n,n,1);
dim3 dimGrid(1,1);
mul<<<dimGrid,dimBlock>>>(a_d,b_d,c_d,n);
cudaMemcpy(c_h,c_d,size,cudaMemcpyDeviceToHost);
printf("multipy");
for(i=0;i<z;i++)
{
if(i%n==0)
{
printf("\n");
}
printf("%d\t",c_h[i]);
}
free(a_h);
free(b_h);
free(c_h);
cudaFree(a_d);
cudaFree(b_d);
cudaFree(c_d);
getch();
```

}

Output:-



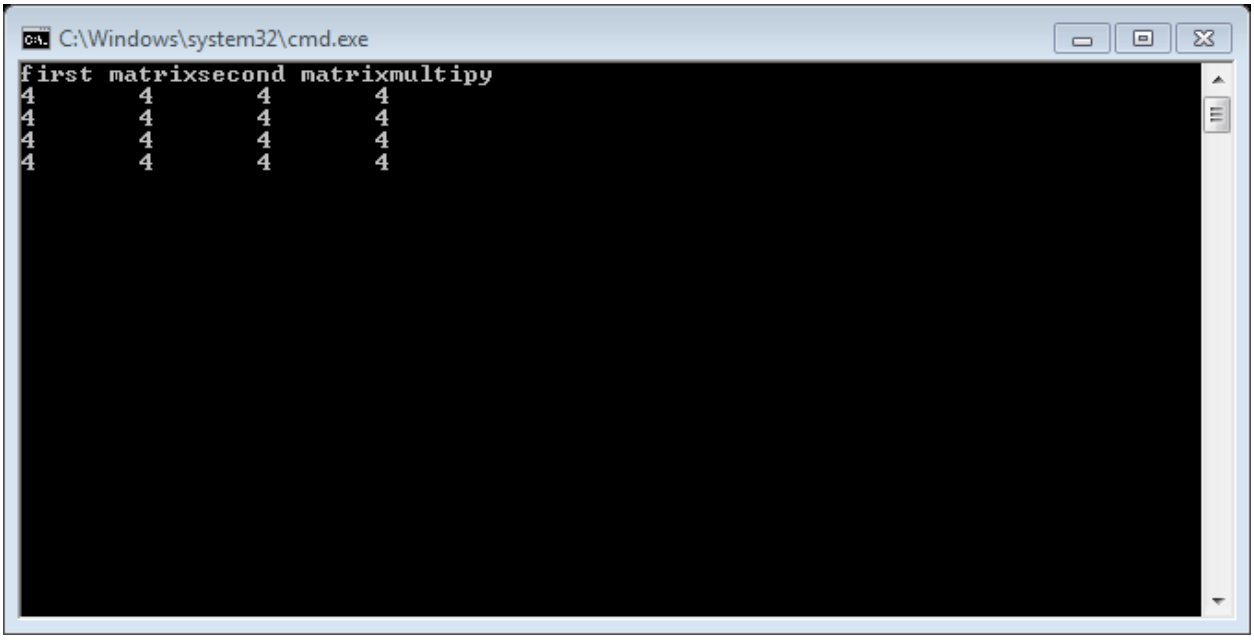
/* multiple block without shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>

__global__ void mul(int* a,int* b,int* c,int n)
{
__shared__ int as[2][2],bs[2][2];
int tx=threadIdx.x;
int ty=threadIdx.y;
int bx=blockIdx.x;
int by=blockIdx.x;
int multi=0;
 bx=blockIdx.x*2+tx;
 by=blockIdx.y*2+ty;
for(int k=0;k<n;k++)
        {
                as[ty][tx]=a[by * n + k];
                bs[ty][tx]=b[bx + n * k];
```

```
                multi +=as[ty][tx]*bs[ty][tx];
        }
        c[by*n+bx]=multi;
}
main()
{
int *a_h,*b_h,*c_h,*a_d,*b_d,*c_d;
int i,n=4,z;
z=n*n;
size_t size=sizeof(int)*z;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
c_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
cudaMalloc((void**)&c_d,size);
printf("first matrix");
for(i=0;i<z;i++)
{
a_h[i]=1;
}
printf("second matrix");
for(i=0;i<z;i++)
{
b_h[i]=1;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
cudaMemcpy(b_d,b_h,size,cudaMemcpyHostToDevice);
dim3 dimBlock(2,2,1);
dim3 dimGrid(2,2);
mul<<<dimGrid,dimBlock>>>(a_d,b_d,c_d,n);
cudaMemcpy(c_h,c_d,size,cudaMemcpyDeviceToHost);
printf("multipy");
for(i=0;i<z;i++)
{
if(i%n==0)
{
printf("\n");
}
printf("%d\t",c_h[i]);
}
free(a_h);
```

```
free(b_h);
free(c_h);
cudaFree(a_d);
cudaFree(b_d);
cudaFree(c_d);
getch();
}
```

Output:-



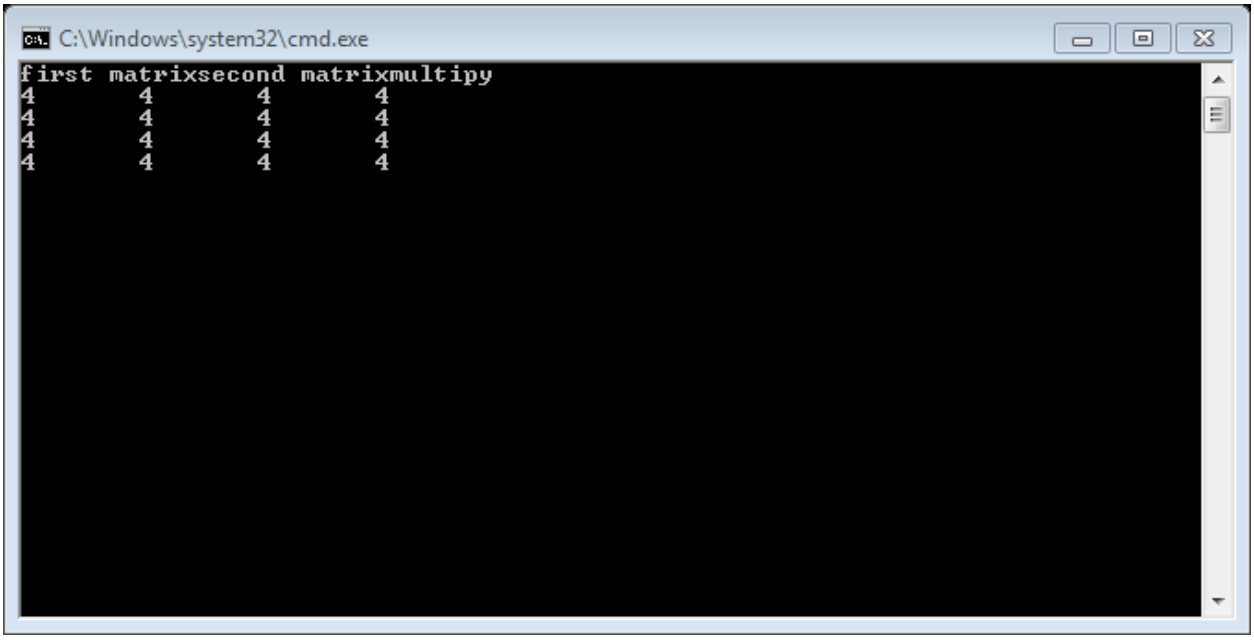
/* single block with shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>

__global__ void mul(int* a,int* b,int* c,int n)
{
__shared__ int as[4][4],bs[4][4];
int tx=threadIdx.x;
int ty=threadIdx.y;
int multi=0;
for(int k=0;k<n;k++)
        {
                as[ty][tx]=a[ty*n+k];
                bs[ty][tx]=b[tx+n*k];
                multi +=as[ty][tx]*bs[ty][tx];
        }
```

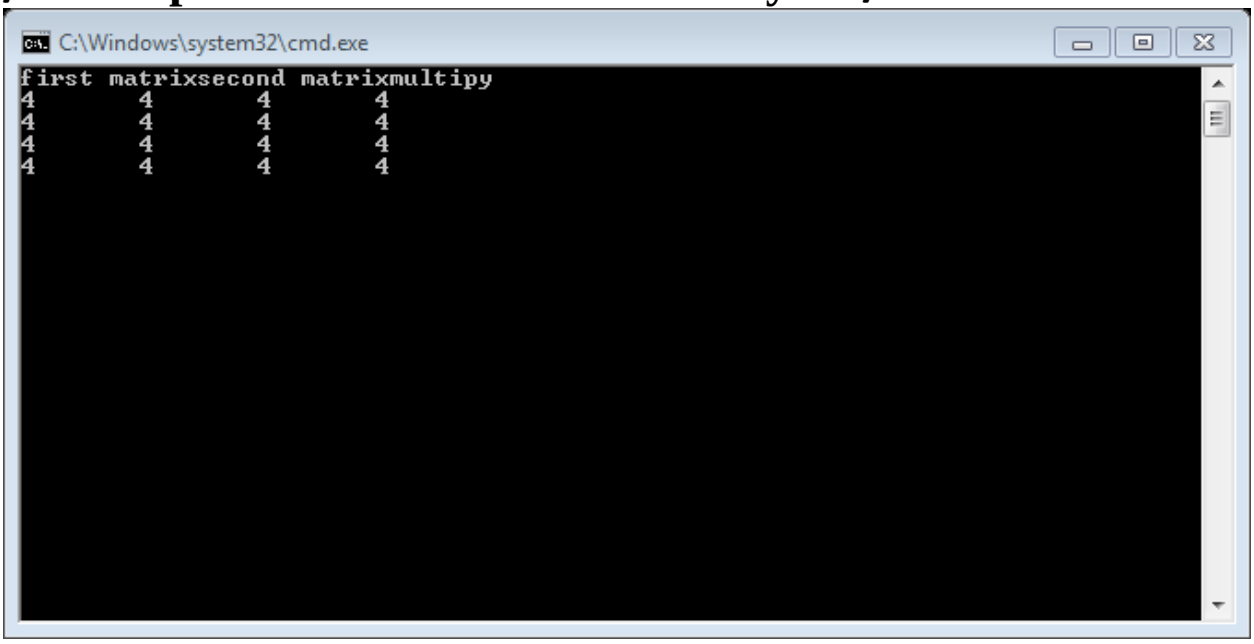
```
            c[ty*n+tx]=multi;
}
main()
{
int *a_h,*b_h,*c_h,*a_d,*b_d,*c_d;
int i,n=4,z;
z=n*n;
size_t size=sizeof(int)*z;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
c_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
cudaMalloc((void**)&c_d,size);
printf("first matrix");
for(i=0;i<z;i++)
{
a_h[i]=1;
}
printf("second matrix");
for(i=0;i<z;i++)
{
b_h[i]=1;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
cudaMemcpy(b_d,b_h,size,cudaMemcpyHostToDevice);
dim3 dimBlock(n,n,1);
dim3 dimGrid(1,1);
mul<<<dimGrid,dimBlock>>>(a_d,b_d,c_d,n);
cudaMemcpy(c_h,c_d,size,cudaMemcpyDeviceToHost);
printf("multipy");
for(i=0;i<z;i++)
{
if(i%n==0)
{
printf("\n");
}
printf("%d\t",c_h[i]);
}
free(a_h);
free(b_h);
free(c_h);
```

```
cudaFree(a_d);
cudaFree(b_d);
cudaFree(c_d);
getch();
}
```

Output:-



/* multiple block with shared memory */



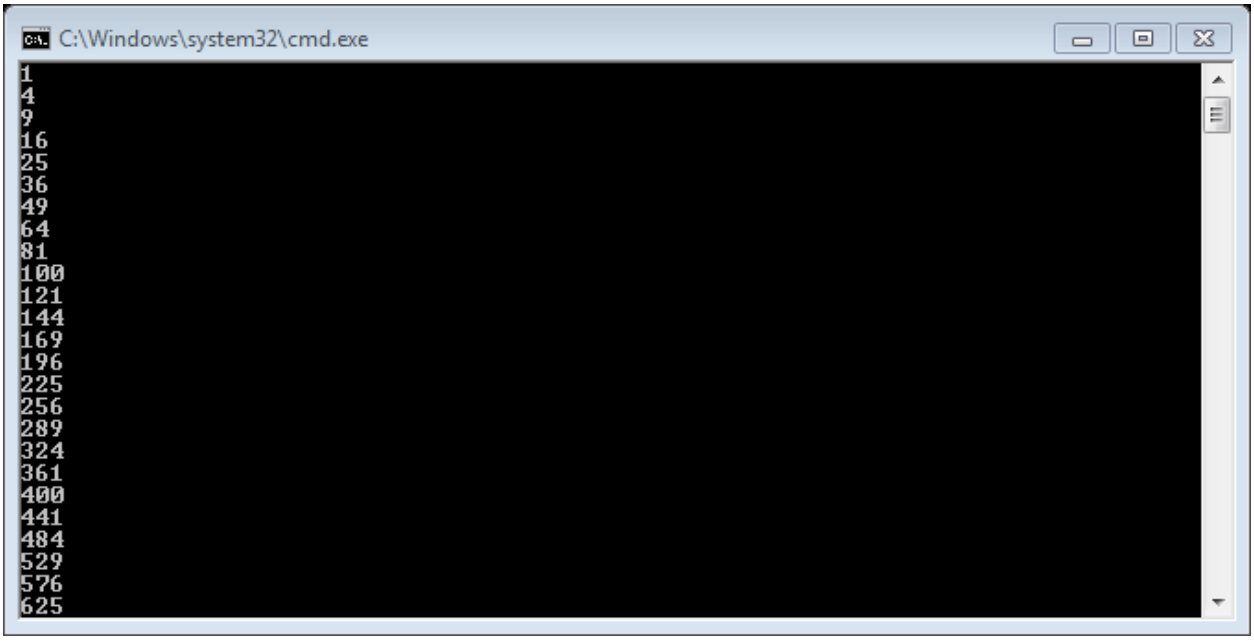
3-Square of first 100 integers

single block without shared memory, single block with shared memory
multiple block without shared memory, multiple block with shared memory

/* single block without shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void seq(int* a,int* b,int n)
{
int id=threadIdx.x;
b[id]=a[id]*a[id];
}
main()
{
int *a_h,*b_h,*a_d,*b_d;
int i,n=100;
size_t size=sizeof(int)*n;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
for(i=1;i<=100;i++)
{
a_h[i]=i;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
dim3 Block(100,1,1);
dim3 Grid(1,1);
seq<<<Grid,Block>>>(a_d,b_d,n);
cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);
for(i=1;i<=100;i++)
{
printf("%d\n",b_h[i]);
}
free(a_h);
free(b_h);
cudaFree(a_d);
cudaFree(b_d);
getch();
```

output:-

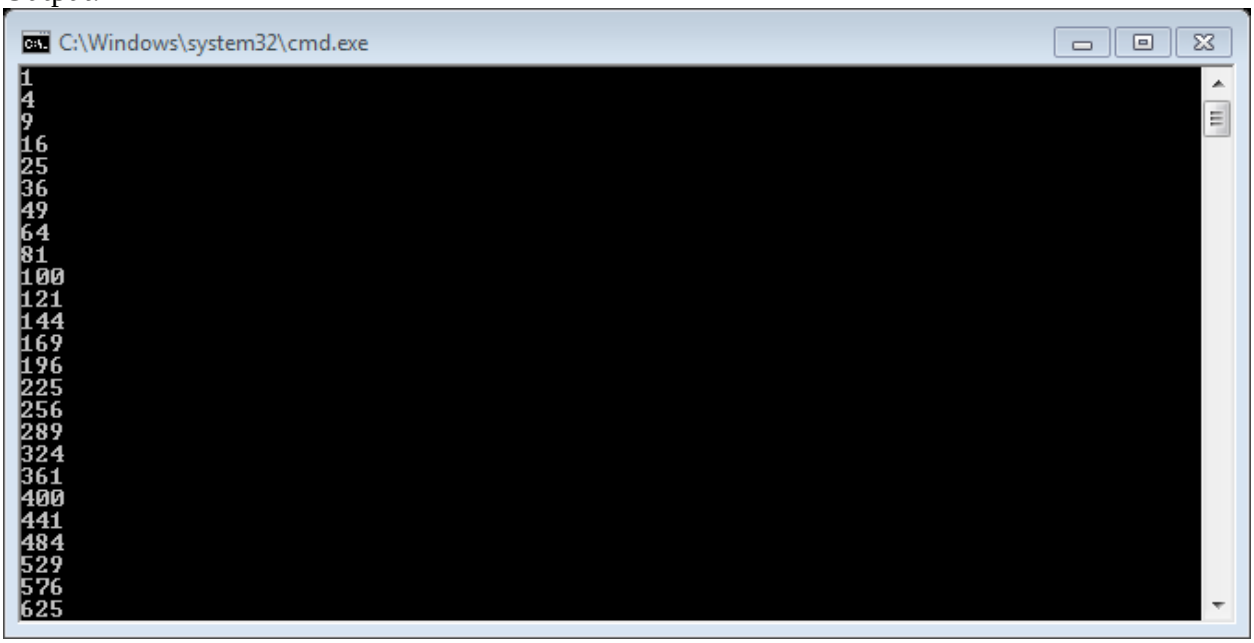


/* single block with shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void seq(int* a,int* b,int n)
{
__shared__ int as[100][1];
int tx=threadIdx.x;
int ty=threadIdx.y;
as[ty][tx]=a[tx]*a[tx];
b[tx]=as[ty][tx];

}
main()
{
int *a_h,*b_h,*a_d,*b_d;
int i,n=100;
size_t size=sizeof(int)*n;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
for(i=1;i<=100;i++)
{
a_h[i]=i;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
dim3 Block(100,1,1);
```

```
dim3 Grid(1,1);
seq<<<Grid,Block>>>(a_d,b_d,n);
cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);
for(i=1;i<=100;i++)
{
printf("%d\n",b_h[i]);
}
free(a_h);
free(b_h);
cudaFree(a_d);
cudaFree(b_d);
getch();
}
```

Output:-

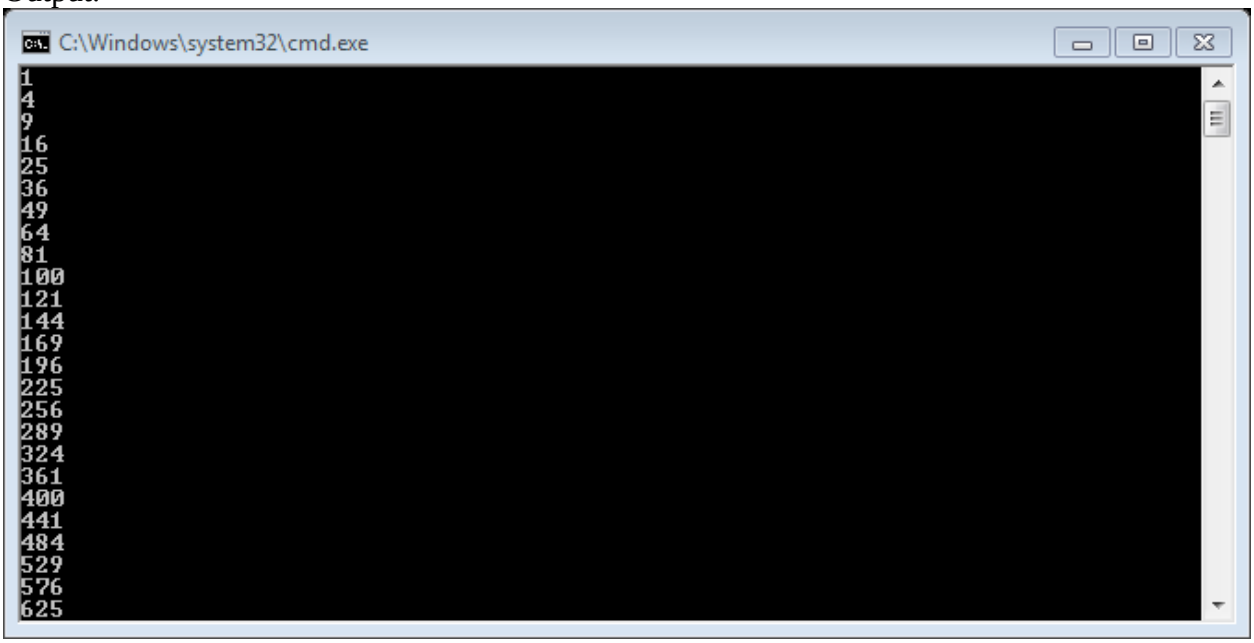


/* multiple block with shared memory */

```
#include<stdio.h>
#include<conio.h>
#include<cuda.h>
__global__ void seq(int* a,int* b,int n)
{
__shared__ int as[100][1];
int tx=threadIdx.x;
int ty=threadIdx.y;
as[ty][tx]=a[tx]*a[tx];
b[tx]=as[ty][tx];

}
main()
```

```
{
int *a_h,*b_h,*a_d,*b_d;
int i,n=100;
size_t size=sizeof(int)*n;
a_h=(int*)malloc(size);
b_h=(int*)malloc(size);
cudaMalloc((void**)&a_d,size);
cudaMalloc((void**)&b_d,size);
for(i=1;i<=100;i++)
{
a_h[i]=i;
}
cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);
dim3 Block(100,1,1);
dim3 Grid(1,1);
seq<<<Grid,Block>>>(a_d,b_d,n);
cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);
for(i=1;i<=100;i++)
{
printf("%d\n",b_h[i]);
}
free(a_h);
free(b_h);
cudaFree(a_d);
cudaFree(b_d);
getch();
}
```

Output:-



4-Matrix Transpose

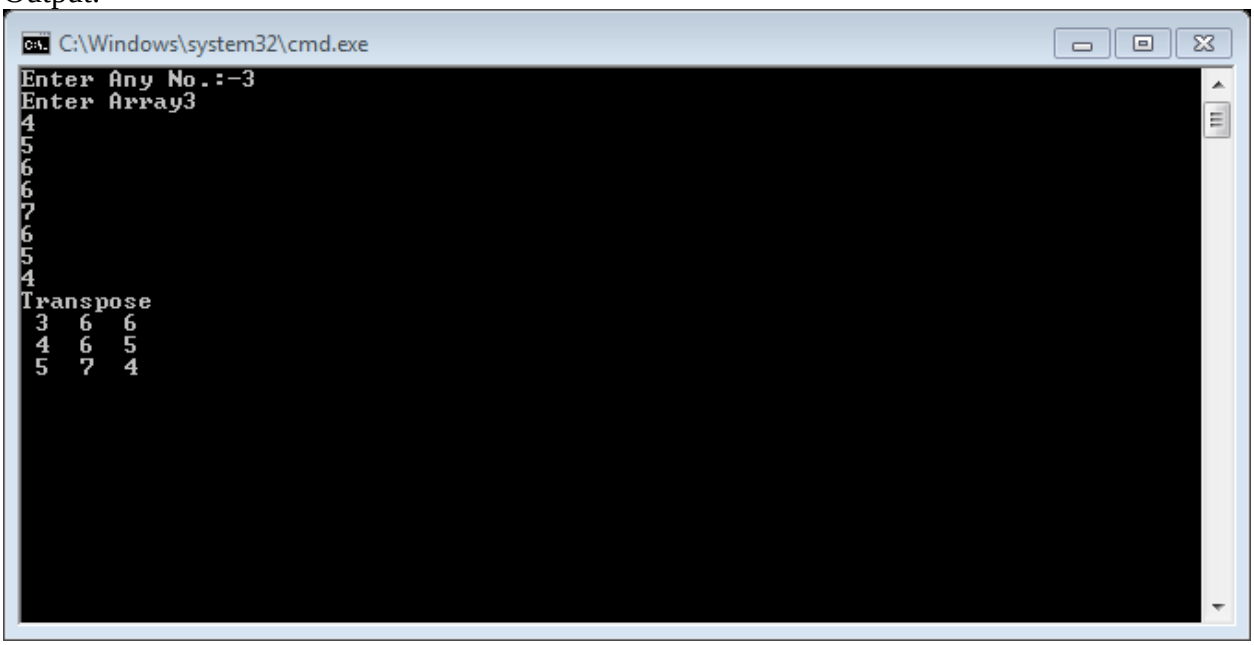
single block without shared memory, single block with shared memory
multiple block without shared memory, multiple block with shared memory

/* single block without shared memory */

```
//Transpose Matrix
#include<stdio.h>
#include<cuda.h>
#include<conio.h>
__global__ void Transport(int* a,int* b,int n)
{
	int h;
		h=a[threadIdx.x + n * threadIdx.y];
		b[threadIdx.y + n *threadIdx.x]=h;
}
main()
{
	int *a_h,*b_h,*a_d,*b_d;
	int i,n,z;
	printf("Enter Any No.:-");
	scanf("%d",&n);
	z=n*n;
	size_t size=sizeof(int)*z;
	a_h=(int*)malloc(size);
	b_h=(int*)malloc(size);
	cudaMalloc((void**)&a_d,size);
	cudaMalloc((void**)&b_d,size);
	printf("Enter Array");
	for(i=0;i<z;i++)
	{
			scanf("%d",&a_h[i]);
	}
	cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);

	dim3 dimBlock(n,n,1);

	dim3 dimGrid(1,1);

	Transport<<<dimGrid,dimBlock>>>(a_d,b_d,n);
	cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);
	printf("Transpose");
	for(i=0;i<z;i++)
  {
		if(i%n==0)
		{
			printf("\n");
```

```
            }
            printf(" %d ",b_h[i]);
        }
        free(a_h);
        free(b_h);
        cudaFree(a_d);
        cudaFree(b_d);
        getch();
        return 0;
}
```

Output:-



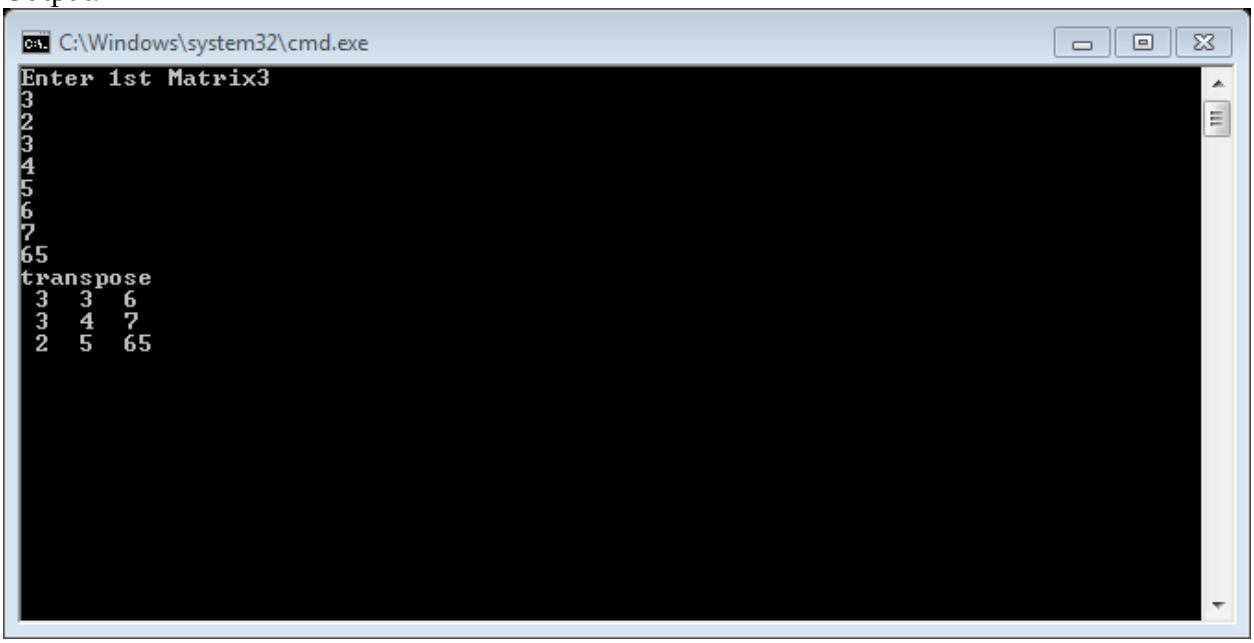
/*, single block with shared memory */

```
#include<stdio.h>
#include<cuda.h>
#include<conio.h>
__global__ void transpose(int* a,int* b,int n)

{
__shared__ int as[3][3];
int tx=threadIdx.x;
int ty=threadIdx.y;

        as[ty][tx]=a[ty*n+tx];
        b[ty+tx*n]=as[ty][tx];

}
```

```
int main()
{
	int *a_h,*a_d,*b_h,*b_d;
	int i,n=3,z;

	z=n*n;
	size_t size=sizeof(int)*z;
	a_h=(int*)malloc(size);
	b_h=(int*)malloc(size);

	cudaMalloc((void**)&a_d,size);

	cudaMalloc((void**)&b_d,size);




	printf("Enter 1st Matrix");
	for(i=0;i<z;i++)
	{
			scanf("%d",&a_h[i]);
	}


	cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);



	dim3 dimBlock(n,n,1);

	dim3 dimGrid(1,1);

	transpose<<<dimGrid,dimBlock>>>(a_d,b_d,n);
	cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);


	printf("transpose");
	for(i=0;i<z;i++)
	{
		if(i%n==0)
		{
			printf("\n");
		}
			printf(" %d ",b_h[i]);
	}
```

```
	free(a_h);
	free(b_h);


	cudaFree(b_d);
	cudaFree(a_d);



	getch();
	return 0;
}
```

Output:-



/* multiple block with shared memory */

```
#include<stdio.h>
#include<cuda.h>
#include<conio.h>
__global__ void transpose(int* a,int* b,int n)

{
	__shared__ int as[2][2];
	int tx=threadIdx.x;
	int ty=threadIdx.y;

int bx=blockIdx.x*2+tx;
int by=blockIdx.y*2+ty;
	as[ty][tx]=a[by*n+bx];
```

```
	b[by+bx*n]=as[ty][tx];

}

int main()
{
	int *a_h,*a_d,*b_h,*b_d;
	int i,n=4,z;

	z=n*n;
	size_t size=sizeof(int)*z;
	a_h=(int*)malloc(size);
	b_h=(int*)malloc(size);

	cudaMalloc((void**)&a_d,size);

	cudaMalloc((void**)&b_d,size);




	printf("Enter 1st Matrix=");
	for(i=0;i<z;i++)
	{
			scanf("%d",&a_h[i]);
	}


	cudaMemcpy(a_d,a_h,size,cudaMemcpyHostToDevice);



	dim3 dimBlock(2,2,1);

	dim3 dimGrid(2,2);

	transpose<<<dimGrid,dimBlock>>>(a_d,b_d,n);
	cudaMemcpy(b_h,b_d,size,cudaMemcpyDeviceToHost);


	printf("transpose");
	for(i=0;i<z;i++)
	{
		if(i%n==0)
		{
			printf("\n");
```

```
            }
                printf(" %d ",b_h[i]);
        }

        free(a_h);
        free(b_h);


        cudaFree(b_d);
        cudaFree(a_d);



        getch();
        return 0;
}
```

Output:-