

EXPERIMENT -2

DOWNSAMPLE AND UPSAMPLE

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UPSAMPLE:

MATLAB:

```
clc;
clear all;
x= [0.5377 1.8339 -2.2588 0.8622 0.3188 -1.3077 -0.4336 0.3426
3.5784 2.7694 -1.3499 3.0349 0.7254 -0.0631 0.7147 -0.2050 -0.1241
1.4897 1.4090 1.4172];

f_1=2;
up_sample_1=u_sample(x,f_1);
disp('The up-sampled signal with factor of 2 is :');
disp(up_sample_1);

f_2=3;
up_sample_2=u_sample(x,f_2);
disp('The up-sampled signal with factor of 3 is :');
disp(up_sample_2);
function up_sample=u_sample(x,f)
    m=length(x);
    up_sample=zeros(1,m*f);
    for i=1:m
        up_sample((i-1)*f+1)=x(i);
    end
end
```

Result:

The up-sampled signal with factor of 2 is:

Columns 1 through 10

0.5377	0	1	.8339	0	-2.2588	0	0.8622	0	0.3188	0
--------	---	---	-------	---	---------	---	--------	---	--------	---

Columns 11 through 20

-1.3077	0	-0.4336	0	0.3426	0	3.5784	0	2.7694	0
---------	---	---------	---	--------	---	--------	---	--------	---

Columns 21 through 30

-1.3499	0	3.0349	0	0.7254	0	-0.0631	0	0.7147	0
---------	---	--------	---	--------	---	---------	---	--------	---

Columns 31 through 40

-0.2050	0	-0.1241	0	1.4897	0	1.4090	0	1.4172	0
---------	---	---------	---	--------	---	--------	---	--------	---

The up-sampled signal with factor of 3 is:

Columns 1 through 10

0.5377 0 0 1.8339 0 0 -2.2588 0 0 0.8622

Columns 11 through 20

0 0 0.3188 0 0 -1.3077 0 0 -0.4336 0

Columns 21 through 30

0 0.3426 0 0 3.5784 0 0 2.7694 0 0

Columns 31 through 40

-1.3499 0 0 3.0349 0 0 0.7254 0 0 -0.0631

Columns 41 through 50

0 0 0.7147 0 0 -0.2050 0 0 -0.1241 0

Columns 51 through 60

0 1.4897 0 0 1.4090 0 0 1.4172 0 0

C code:

```
#include <stdio.h>

void up_sample(double x[],int m,int f,double up[]){
    for(int i=0;i<m;i++){
        up[i*f]= x[i];
    }
}

int main(){
    double x[]={0.5377,1.8339,-2.2588,0.8622,0.3188,-1.3077,-
0.4336,0.3426,3.5784,2.7694,-1.3499,3.0349,0.7254,-0.0631,0.7147,-
0.2050,-0.1241,1.4897,1.4090,1.4172};
    int m = sizeof (x)/sizeof(x[0]);
    int f_1=2;
    int f_2=3;
    double up_1[m*f_1];
    for (int i = 0; i < m * f_1; i++) {
        up_1[i] = 0.0;
    }
    up_sample(x,m,f_1,up_1);
    printf("The output of up-sampling with factor of 2 is:\n");
    for (int i=0;i<m*f_1;i++){
        printf("%f  ", up_1[i]);
    }
    double up_2[m*f_2];
    for (int i = 0; i < m * f_2; i++) {
        up_2[i] = 0.0;
    }
    up_sample(x,m,f_2,up_2);
```

```

printf("The output of up-sampling with factor of 3 is: \n");
for (int i=0;i<m*f_2;i++){
    printf("%f ", up_2[i]);
}
return 0;
}

```

Result:

The output of up-sampling with factor of 2 is:

```

0.537700 0.000000 1.833900 0.000000 -2.258800 0.000000 0.862200
0.000000 0.318800 0.000000 -1.307700 0.000000 -0.433600 0.000000
0.342600 0.000000 3.578400 0.000000 2.769400 0.000000 -1.349900
0.000000 3.034900 0.000000 0.725400 0.000000 -0.063100 0.000000
0.714700 0.000000 -0.205000 0.000000 -0.124100 0.000000 1.489700
0.000000 1.409000 0.000000 1.417200 0.000000

```

The output of up-sampling with factor of 3 is:

```

0.537700 0.000000 0.000000 1.833900 0.000000 0.000000 -2.258800
0.000000 0.000000 0.862200 0.000000 0.000000 0.318800 0.000000
0.000000 -1.307700 0.000000 0.000000 -0.433600 0.000000 0.000000
0.342600 0.000000 0.000000 3.578400 0.000000 0.000000 2.769400
0.000000 0.000000 -1.349900 0.000000 0.000000 3.034900 0.000000
0.000000 0.725400 0.000000 0.000000 -0.063100 0.000000 0.000000
0.714700 0.000000 0.000000 -0.205000 0.000000 0.000000 -0.124100
0.000000 0.000000 1.489700 0.000000 0.000000 1.409000 0.000000
0.000000 1.417200 0.000000 0.000000

```

DOWN-SAMPLE:

MATLAB:

```

clc;
clear all;
x= [0.5377 1.8339 -2.2588 0.8622 0.3188 -1.3077 -0.4336 0.3426
3.5784 2.7694 -1.3499 3.0349 0.7254 -0.0631 0.7147 -0.2050 -0.1241
1.4897 1.4090 1.4172];
f_1=2;
down_sample_1 = d_sample(x,f_1);
disp('The down-sampled value with factor 2 is: ');
disp(down_sample_1);

```

```

f_2=3;
down_sample_2=d_sample(x,f_2);
disp('The down-sampled value with factor 3 is: ');
disp(down_sample_2);
function down_sample=d_sample(x,f)
    m= length(x);
    down_sample=zeros(1,floor(m/f));
    for i=1:f:m
        down_sample((i+f-1)/f)=x(i);
    end
end
end

```

RESULT:

The down-sampled value with factor 2 is:

```

0.5377 -2.2588  0.3188 -0.4336  3.5784 -1.3499  0.7254  0.7147  -
0.1241  1.4090

```

The down-sampled value with factor 3 is:

```

0.5377  0.8622 -0.4336  2.7694  0.7254 -0.2050  1.4090

```

C CODE:

```

#include <stdio.h>
#define MAX_SIZE 100
void down_sample(double x[],int f,int m,double d[]){

    for(int i=0;i<(m+f-1)/f;i++){
        d[i]=x[i*f];
    }
}

int main(){
    double x[]={0.5377,1.8339,-2.2588,0.8622,0.3188,-1.3077,-
0.4336,0.3426,3.5784,2.7694,-1.3499,3.0349,0.7254,-0.0631,0.7147,-
0.2050,-0.1241,1.4897,1.4090,1.4172};
    int m=sizeof(x) / sizeof(x[0]);
    int f_1=2;
    double d_1[m/f_1];
    down_sample(x,f_1,m,d_1);
    int f_2=3;
    double d_2[m/f_2];
    down_sample(x,f_2,m,d_2);
    printf("The down-sampled signal with factor of 2 is\n");
    for(int i=0;i<(m+f_1-1)/f_1;i++){
        printf("%f ",d_1[i]);
    }
}

```

```
}  
printf("The down-sampled signal with factor of 3 is\n\n");  
for (int i=0;i<(m+f_2-1)/f_2;i++){  
    printf("%f",d_2[i]);  
}  
return 0;  
}
```

RESULT:

The down-sampled signal with factor of 2 is

0.537700 -2.258800 0.318800 -0.433600 3.578400 -1.349900
0.725400 0.714700 -0.124100 1.409000

The down-sampled signal with factor of 3 is

0.537700 0.862200 -0.433600 2.769400 0.725400
-0.205000 1.409000