1 question

As I was instructed during tutorial, I copied Formula for Lagrange interpolation from the internet.

```
Double lagrange (double *x, double *y, int n, double xx)
{
int i, j;
double yint, ylag;
yint = 0.0;
for (i = 0; i < n; i++)
   {
ylag = 1.0;
for (j = 0; j < n; j++)
            {
if (i == j)
continue;
ylag *= (xx - x[j]) / (x[i] - x[j]);


}



yint += y[i] * ylag;
}
return yint;
}
```

2 question

I created a new file manually in online C compiler.

3 question

Firstly I opened file from question 2 for reading. Then using code I create file for interpolation results.

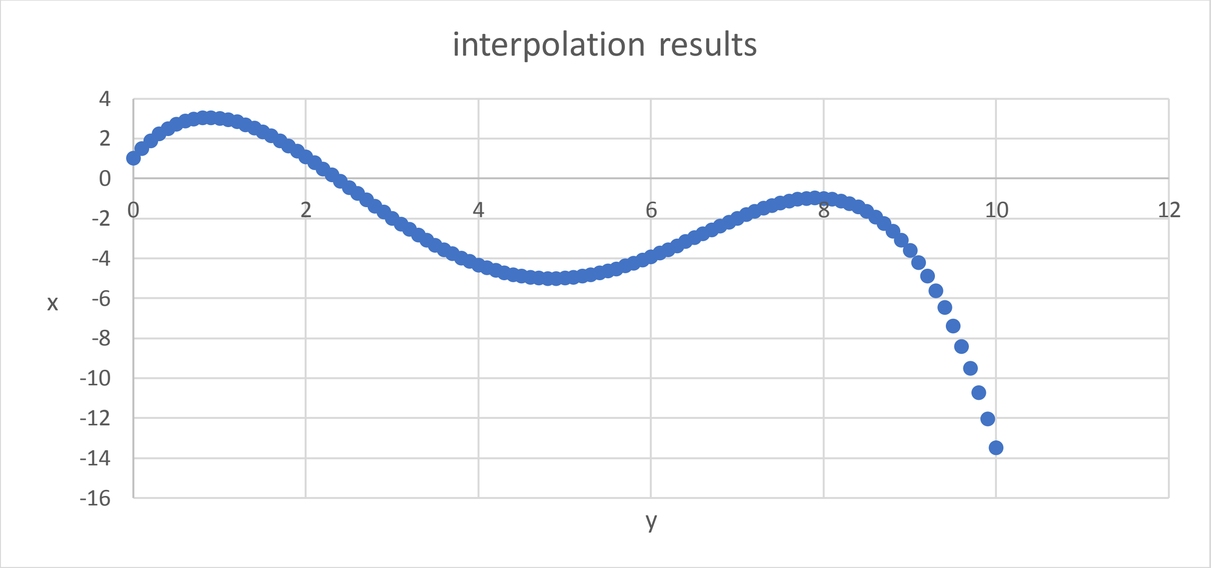
```
FILE * fp = fopen ("interpolation_data.ini", "r");


FILE * f = fopen ("interpolation_result.dat", "w");
```

Then I scanned values from interpolation data and computed interpolation results. I used for loop with double I instead of int I before I was told, that it is not generally used. I didn’t change the code because it worked, but later on I used integer parameter and additional double variable. I printed both in console and in file to be able to quickly verify my code.

```
fscanf (fp, "%d", &n);
double x[n];
double y[n];
for (int i = 0; i <= n; i++)
   {
fscanf (fp, "%lf" "%lf", &x[i], &y[i]);
}
for (double i = x[0]; i <= x[n]; i += (x[n] - x[0]) / 100)
   {
printf ("\nValue at x = %lf is equal to: %lf", i,
		lagrange (x, y, n, i));
fprintf (f, "\n%lf\t" "%lf", i, lagrange (x, y, n, i));
}
```

4 question



5 question

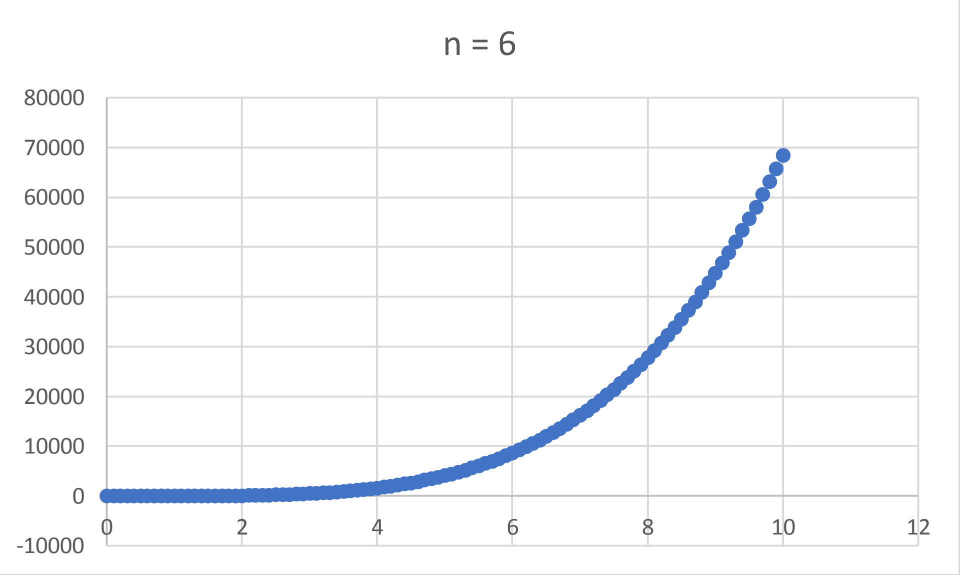
I created two new arrays x2 and y2 to distinguish them from the ones from previous exercises. I created function Bad which returns value of given formula

```
double Bad(double x){
   return(1.0/(10.0*x*x));
}
```

Then I filled x2 with uniformly distributed nodes between -1 and 1. Then I added corresponding values to y2.

```
for(int i = 0; i < d; i++){
   x2[i] = -1.0 + (i*(2.0/(d-1)));
   y2[i] = Bad(x2[i]);
}
```

Later I created code to compute interpolate values of g for points from exercise 3. I received, however, strange results which indicates my fault somewhere, but I couldn’t find it. I attach only graph for number of interpolation base points equal to 6 because if I include n = 20 and 40 first graph is nearly vertical line.



```
int d = 6;

double x2[d];

double y2[d];

double Bad(double x){

   return(1.0/(10.0*x*x));

}

for(int i = 0; i < d; i++){

   x2[i] = -1.0 + (i*(2.0/(d-1)));

   y2[i] = Bad(x2[i]);

}

double point = 0.0;

for(int j = 0; j < d; j++){

   fprintf(g, "%lf\t %.3lf\n",point, lagrange(x2, y2, d, point));

   point += 0.1;
}
```

6 question

I examined, copied and modified formula for Newtons interpolation polynominal from the internet.

```
double Newton(double *ax, double *ay, double x, double n){
   double h=ax[1]-ax[0];
   double diff[MAXN+1][ORDER+1];
   double p, yp;
   double nr = 1.0;
   double dr = 1.0;
   for (int i=0;i<=n-1;i++)
      diff[i][1] = ay[i+1]-ay[i];

   for (int j=2;j<=ORDER;j++)
      for(int i=0;i<=n-j;i++)
      diff[i][j] = diff[i+1][j-1] - diff[i][j-1];

   int i=0;
   while (!(ax[i]>x))
      i++;

   i--;
   p = (x-ax[i])/h;
   yp = ay[i];

   for (int k=1;k<=ORDER;k++)
   {
      nr *=p-k+1;
      dr *=k;
      yp +=(nr/dr)*diff[i][k];
```

```
    }

    return yp;


}
```