Submission Date: Monday 4th November 2019, 11pm Assessed Coursework 1 – Solution Template

Your results to the assessed coursework must be submitted using this template. Please cut and paste the subsequent output into the correct parts of this file. Once this template has been completed, you must then create a pdf file for submission. Under Windows 10/Windows 7 use Texmaker 5; this may be accessed as follows:

`Start > UoN Applications > (UoN) Texmaker 5`

Open this file under `File`*; to build the pdf file, click the arrow next to* `Quick Build`*; this will then generate the file course_work1_submission.pdf.*
A single zip or tar file containing your solution should be submitted *through the module webpage on Moodle.* **NOTE:** *All parameters and values (such as polynomial degrees etc.) should be set within your codes: do NOT use inputs such as obtained with* `std::cin`.

File checklist:
course_work1_submission.pdf
`newtonhorner.cpp` containing the functions `horner` and `newton`
`chebyshev.cpp` containing the functions `chebeval`, `chebsum`, and `chebcoef`
`lagrange.cpp` containing the function `lagrange`
`q1a.cpp`
`q1b.cpp`
`q1c.cpp`
`q2a.cpp`
`q2b.cpp`
`q3.cpp`
`q3b.cpp`
`runge.pdf`

1(a) Enter your output here:

```
The polynomial evaluated at x is: 3.625
```

1(b) Enter your output here:

```
An approximate root of x^2-1, with nmax = 10 and initial guess z0 = 4, is: 1

An approximate root of x^5+x^4-9x^3-x^2+20x-12, with nmax = 5 and
initial guess z0 = 4, is: 2.05777

An approximate root of x^5+x^4-9x^3-x^2+20x-12, with nmax = 10 and
initial guess z0 = 4, is: 2
```

1(c) Enter your output here:

```
The approximate roots of x^5+x^4-9x^3+20x-12 are:
x = 2
x = 1.00001
x = 0.999992
x = -2
x = -3
```

2(a) Enter your output here:

```
P2(0.5) = -0.5
P3(-0.5) = 1
P9(0.7) = 0.640687
```

2(b) Enter your output here:

```
For a[i]=i:
The Chebyshev sum for n = 10, x = -1 is 5
The Chebyshev sum for n = 10, x = -0.5 is -0.5
The Chebyshev sum for n = 10, x = 0 is -6
The Chebyshev sum for n = 10, x = 0.5 is -11.5
The Chebyshev sum for n = 10, x = 1 is 55
```

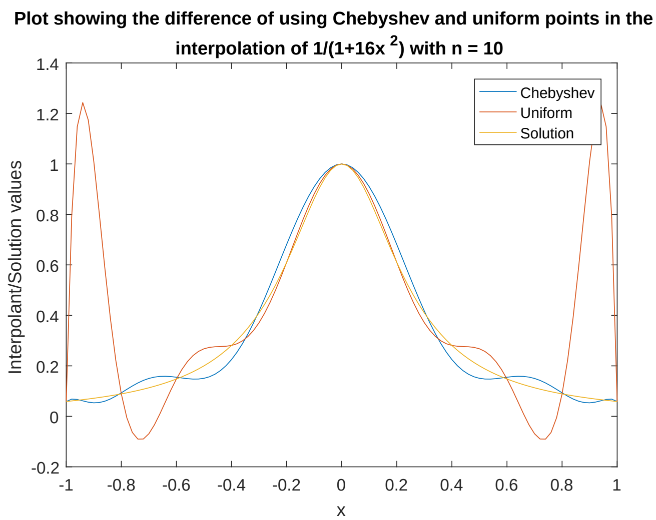
3(a) Enter your output here:

```
The Lagrangian form of the interpolating polynomial using uniform points, with
f(x) = x^4+x and n = 2 evaluated at x = 1/6 is 0.194444 and the error is 0.0270062

The Lagrangian form of the interpolating polynomial using uniform points, with
f(x) = x^4+x and n = 4 evaluated at x = 1/6 is 0.167438 and the error is 2.77556e-017
```

3(b) Enter your output here:

```
The Lagrangian form of the interpolating polynomial with f(x) = x^4+x,
n = 2 and evaluated at x = 1/6 using:
Uniform points is 0.194444 and the error is 0.0270062
Chebyshev points is 0.194444 and the error is 0.0270062

The Lagrangian form of the interpolating polynomial with f(x) = 1/(1+16x^2),
evaluated with:
Uniform points at x = 0.166667 and n = 2 is 0.973856 and the error is 0.281549
Chebyshev points at x = 0.166667 and n = 2 is 0.973856 and the error is 0.281549
Uniform points at x = 0.166667 and n = 10 is 0.705979 and the error is 0.0136716
Chebyshev points at x = 0.166667 and n = 10 is 0.766776 and the error is 0.0744687
```

```
Uniform points at x = 0.9 and n = 2 is 0.237647 and the error is 0.166014
Chebyshev points at x = 0.9 and n = 2 is 0.237647 and the error is 0.166014
Uniform points at x = 0.9 and n = 10 is 1.01067 and the error is 0.939037
Chebyshev points at x = 0.9 and n = 10 is 0.0535164 and the error is 0.0181169
```



3(c) Enter your output here:

```
The Chebyshev coefficients are:
0.529412
6.245e-017
-0.470588
```

```
The error is 0.166014
```