

### HW3 - Exercise 1b

#### [A1] Traditional

```
x = linspace(1.5, 2.5, 10000);  
n = 13;
```

```
px_A1 = 1;  
for i = 1:n  
    px_A1 = px_A1 .* (x - 2);  
end
```

px\_A1

px\_A1 = 1×10000

10<sup>-3</sup> ×

-0.1221   -0.1218   -0.1214   -0.1211   -0.1208   -0.1205   -0.1202   -0.1199   -0.1196   -0.11

#### Coefficients:

```
c = poly(ones(n,1)*2);  
c
```

c = 1×14

1   -26   312   -2288   11440   -41184   109824   -219648

#### [A2] Horner's:

```
px_A2 = c(1);  
for i = 2:n+1  
    px_A2 = c(i) + x.*px_A2;  
end  
px_A2
```

px\_A2 = 1×10000

10<sup>-3</sup> ×

-0.1221   -0.1218   -0.1214   -0.1211   -0.1208   -0.1205   -0.1202   -0.1199   -0.1196   -0.11

#### ds

```
% xtoi=1; px=c(n+1);  
% for i=n:-1:1  
%     xtoi = xtoi.*x;  
%     px=px+c(i).*xtoi;  
% end  
% px
```

#### [A3]

```
if (c(n+1) > 0)  
    pos=c(n+1);
```

```

        neg=0;
    else
        neg=c(n+1);
        pos=0;
    end;
    xtoi=1;
    for i=n:-1:1
        xtoi = xtoi.*x;
        dsum = c(i).*xtoi;
        if (dsum > 0)
            pos=pos+dsum;
        else neg=neg+dsum;
        end;
        pos+neg;
    end;
    px_A3=pos+neg

```

```
px_A3 = 1×10000
```

$10^{-3} \times$

```

    -0.1221    -0.1218    -0.1214    -0.1211    -0.1208    -0.1205    -0.1202    -0.1199    -0.1196    -0.11

```

Plots:

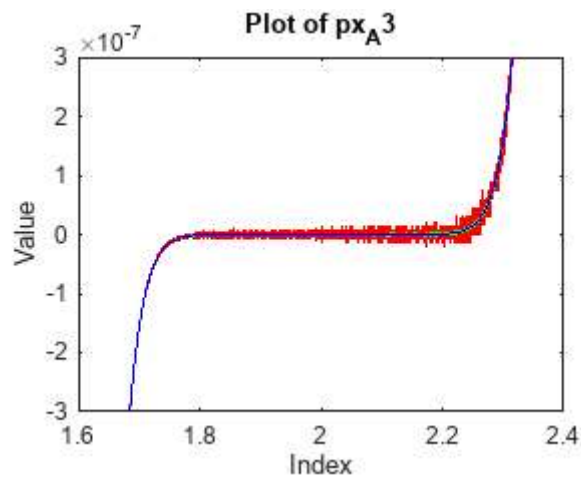
```

figure;
plot(x, px_A3, 'r');
hold on;
% ylim([-3E-7, 3E-7]);
% title('Plot of px_A1');
% xlabel('Index');
% ylabel('Value');

% figure;
plot(x, px_A2, 'g');
% ylim([-3E-7, 3E-7]);
% title('Plot of px_A2');
% xlabel('Index');
% ylabel('Value');

% figure;
plot(x, px_A1, 'b');
hold off;
ylim([-3E-7, 3E-7]);
title('Plot of px_A3');
xlabel('Index');
ylabel('Value');

```

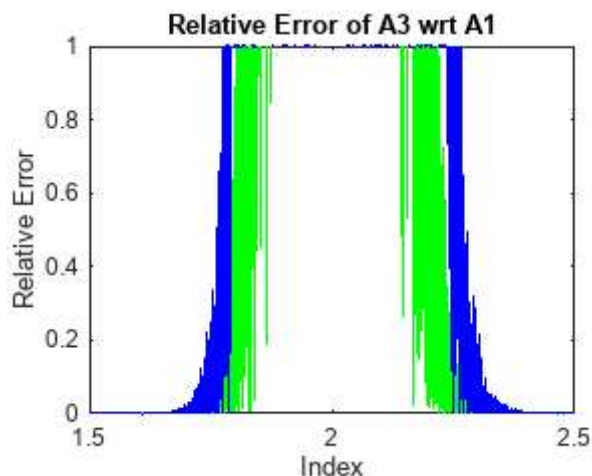


Relative errors of A2 and A3 wrt A1:

```
relativeErrorPx_A2 = abs((px_A2 - px_A1) ./ px_A1);
relativeErrorPx_A3 = abs((px_A3 - px_A1) ./ px_A1);

% Plot the relative error of px_A2
figure;
plot(x, relativeErrorPx_A2, 'g');
hold on;
% ylim([0, 1]);
% title('Relative Error of A2 wrt A1');
% xlabel('Index');
% ylabel('Relative Error');

% figure;
plot(x, relativeErrorPx_A3, 'b');
hold off;
ylim([0, 1]);
title('Relative Error of A3 wrt A1');
xlabel('Index');
ylabel('Relative Error');
```



Zoomed into range  $x$  in  $[2-\text{eps}, 2+\text{eps}]$

```
radius = 1E-3;
```

```

% Plot the relative error of px_A2
figure;
plot(x, relativeErrorPx_A2, 'g');
hold on;
% ylim([0, 1E3]);
% xlim([2-radius, 2+radius]);
% title('Relative Error of A2 wrt A1');
% xlabel('Index');
% ylabel('Relative Error');

% figure;
plot(x, relativeErrorPx_A3, 'b');
hold off;
xlim([2-radius, 2+radius]);
ylim([0, 1]);
title('Relative Error of A3 wrt A1');
xlabel('Index');
ylabel('Relative Error');

```

