ME 1020 Engineering Programming with MATLAB

Problem 5.24:

24. The current amount A of a principal P invested in a savings account paying an annual interest rate r is given by

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

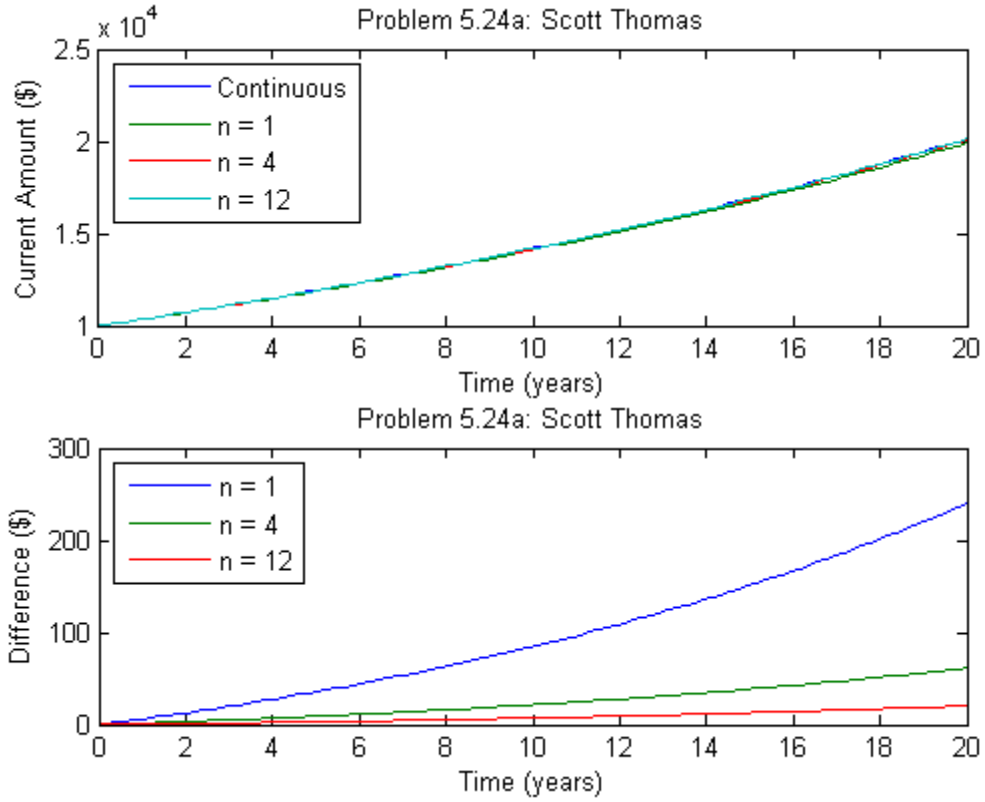
where n is the number of times per year the interest is compounded. For continuous compounding, $A = Pe^{rt}$. Suppose \$10 000 is initially invested at 3.5 percent ($r = 0.035$).

a. Plot A versus t for $0 \leq t \leq 20$ years for four cases: continuous compounding, annual compounding ($n = 1$), quarterly compounding ($n = 4$), and monthly compounding ($n = 12$). Show all four cases on the same subplot and label each curve. On a second subplot, plot the difference between the amount obtained from continuous compounding and the other three cases.

b. Redo part *a*, but plot A versus t on log-log and semilog plots. Which plot gives a straight line?

```
% Problem 5.24a
clear
clc
disp('Problem 5.24a: Scott Thomas')

r = 0.035;
P = 10^4;
N = 100;
n = [1 4 12];
t = linspace(0,20,N);
Acont = P*exp(r*t);
A1 = P*(1 + r/n(1)).^(n(1).*t);
A2 = P*(1 + r/n(2)).^(n(2).*t);
A3 = P*(1 + r/n(3)).^(n(3).*t);

diff1 = Acont - A1;
diff2 = Acont - A2;
diff3 = Acont - A3;

subplot(2,1,1)
plot(t,Acont, t,A1, t,A2, t,A3)
ylabel('Current Amount ($)'), xlabel('Time (years)')
title('Problem 5.24a: Scott Thomas')
legend('Continuous','n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
subplot(2,1,2)
plot(t,diff1, t,diff2, t,diff3)
ylabel('Difference ($)'), xlabel('Time (years)')
title('Problem 5.24a: Scott Thomas')
legend('n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
```

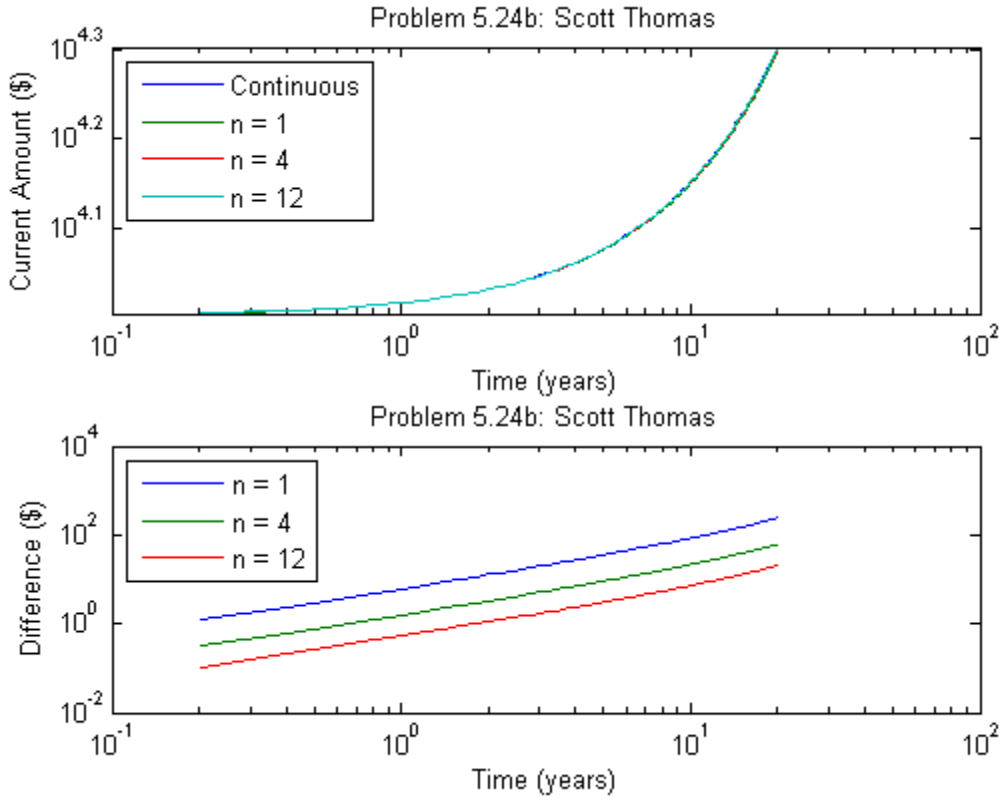
```
Problem 5.24a: Scott Thomas
```




```
% Problem 5.24b
clear
clc
disp('Problem 5.24b: Scott Thomas')

r = 0.035;
P = 10^4;
N = 100;
n = [1 4 12];
t = linspace(0,20,N);
Acont = P*exp(r*t);
A1 = P*(1 + r/n(1)).^(n(1).*t);
A2 = P*(1 + r/n(2)).^(n(2).*t);
A3 = P*(1 + r/n(3)).^(n(3).*t);

diff1 = Acont - A1;
diff2 = Acont - A2;
diff3 = Acont - A3;

subplot(2,1,1)
loglog(t,Acont, t,A1, t,A2, t,A3)
ylabel('Current Amount ($)'), xlabel('Time (years)')
title('Problem 5.24b: Scott Thomas')
legend('Continuous','n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
subplot(2,1,2)
loglog(t,diff1, t,diff2, t,diff3)
ylabel('Difference ($)'), xlabel('Time (years)')
```

```
title('Problem 5.24b: Scott Thomas')
legend('n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
```

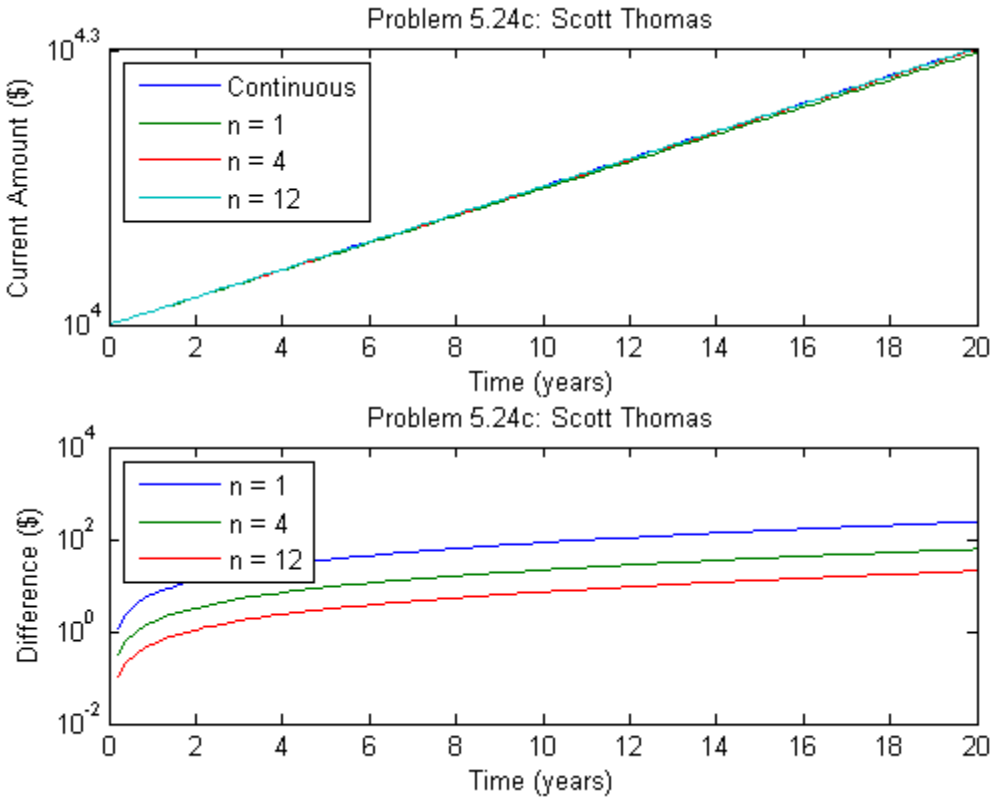
```
Problem 5.24b: Scott Thomas
```




```
% Problem 5.24c
clear
clc
disp('Problem 5.24c: Scott Thomas')

r = 0.035;
P = 10^4;
N = 100;
n = [1 4 12];
t = linspace(0,20,N);
Acont = P*exp(r*t);
A1 = P*(1 + r/n(1)).^(n(1).*t);
A2 = P*(1 + r/n(2)).^(n(2).*t);
A3 = P*(1 + r/n(3)).^(n(3).*t);

diff1 = Acont - A1;
diff2 = Acont - A2;
diff3 = Acont - A3;

subplot(2,1,1)
semilogy(t,Acont, t,A1, t,A2, t,A3)
ylabel('Current Amount ($)'), xlabel('Time (years)')
title('Problem 5.24c: Scott Thomas')
```

```
legend('Continuous','n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
subplot(2,1,2)
semilogy(t,diff1, t,diff2, t,diff3)
ylabel('Difference ($)'), xlabel('Time (years)')
title('Problem 5.24c: Scott Thomas')
legend('n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
```

```
Problem 5.24c: Scott Thomas
```




```
% Problem 5.24d
clear
clc
disp('Problem 5.24d: Scott Thomas')

r = 0.035;
P = 10^4;
N = 100;
n = [1 4 12];
t = linspace(0,20,N);
Acont = P*exp(r*t);
A1 = P*(1 + r/n(1)).^(n(1).*t);
A2 = P*(1 + r/n(2)).^(n(2).*t);
A3 = P*(1 + r/n(3)).^(n(3).*t);

diff1 = Acont - A1;
diff2 = Acont - A2;
diff3 = Acont - A3;
```

```
subplot(2,1,1)
semilogx(t,Acont, t,A1, t,A2, t,A3)
ylabel('Current Amount ($)'), xlabel('Time (years)')
title('Problem 5.24d: Scott Thomas')
legend('Continuous','n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
subplot(2,1,2)
semilogx(t,diff1, t,diff2, t,diff3)
ylabel('Difference ($)'), xlabel('Time (years)')
title('Problem 5.24d: Scott Thomas')
legend('n = 1', 'n = 4', 'n = 12', 'Location', 'NorthWest')
```

```
Problem 5.24d: Scott Thomas
```