PUBLISHER SOLUTION AND TEXTBOOK ERRATA
(Updated as problems are brought to my attention)

This version: November 4th, 2019

Chapter 2

2.4
(a) P = 1,000, i = 10% per year, N = 2 years.
$F = P(1 + i)^N = 1{,}000(1 + 0.10)^2 = 1{,}210$

The balance at the end of 2 years will be €1,210

(b) P = 900, APR = 12% compounded monthly.
12 months in a year → i = 12%/12 = 1% per month
N = 2 years = 24 months

$F = P(1 + i)^N = 900(1 + 0.01)^{24} = 1{,}142.76$

The balance at the end of 2 years will be €1,142.76

2.32

The publisher solution to the second part is incorrectly calculated.

7.5% APR compounded annually = 7.5% interest per year.
X = \$3,500 x (P/F,7.5%,5) = \$2,437.96

7.5% APR compounded daily = 7.5%/365 interest per day.
Required value is \$2,437.96 x (F/P,7.5%/365,10x365) = \$5,160.75

2.46
As phrased, the question implies that you are asking for \$300,000 today, and \$700,000 (the balance of the total prize money) five years from now. Trivially, the payment five years from now will be \$700,000.

The solution in the publisher-provided answer key answers a different question, which could be phrased thus:

"The lottery in question 2.45 has a present value of \$665,270. Suppose the lottery authority offers you an alternate prize: take \$300,000 now, and \$X, five years from now. Calculate the minimum value of X that would lead you to prefer the alternate prize to the lottery in question

2.45. (That is, calculate the value of X that leaves you indifferent between the two in present value terms.)”

Chapter 3

Review Problem 3.2
There’s an error in the solution: FW(gradient, end of five years) = 47,363 (not 43,363).

3.7
The ‘$18,400’ comment at the end of the solution is a typo. The yearly savings required are about $9,716.40, as indicated by the calculations in the solution.

3.40
There’s a typo in the solution, where the solution wrote 1,000 instead of 10,000. (Both geometric gradients have the same initial cash flow of $10,000.)

This typo does not affect the calculations, which are valid as written to within rounding error (the exact solution is P = $210,951.22 – see table below).

The second half of the solution should read,

$P = 10\ 000(P/A, g, i_e, 12) + 10\ 000(P/A, g, i_e, 12)(F/P, i, 1)$
$P = 10\ 000[(P/A, i°, 12)/(1 + g)][1 + (F/P, 0.015, 1)]$
$P = 10\ 000[(P/A, 0.02, 12)/1.01](1 + 1.0150)$
$P = 10\ 000(10.575/1.01)(2.015) = 210\ 976$

Month	Cash Flow	PV (i = 1.5%)	Month	Cash Flow	PV (i = 1.5%)
1	$ 10,000.00	$9,852.22	14	$ 10,615.20	$8,617.94
2	$ 10,000.00	$9,706.62	15	$ 10,721.35	$8,575.49
3	$ 10,100.00	$9,658.80	16	$ 10,721.35	$8,448.76
4	$ 10,100.00	$9,516.06	17	$ 10,828.57	$8,407.14
5	$ 10,201.00	$9,469.18	18	$ 10,828.57	$8,282.90
6	$ 10,201.00	$9,329.24	19	$ 10,936.85	$8,242.09
7	$ 10,303.01	$9,283.29	20	$ 10,936.85	$8,120.29
8	$ 10,303.01	$9,146.10	21	$ 11,046.22	$8,080.29
9	$ 10,406.04	$9,101.04	22	$ 11,046.22	$7,960.88
10	$ 10,406.04	$8,966.54	23	$ 11,156.68	$7,921.66
11	$ 10,510.10	$8,922.37	24	$ 11,156.68	$7,804.59
12	$ 10,510.10	$8,790.52	Total		$210,951.22
13	$ 10,615.20	$8,747.21			

3.51

The publisher solution mistakenly uses a positive value, i^O=3.81%, instead of a negative value, i^O=-3.81%, in its calculations.

We're told the APR is 12%, compounded monthly. Since there are 12 months in a year, this is basically just saying the relevant interest rate is 1% per month.

So, let's use that as our MARR.

There are two parts to this project: the costs, and the installment payments. We want the present value of those to be equal in magnitude, so that the total present value is zero.

The costs are a geometric gradient with A = -$15,000, g = 5%, i = 1% and N = 12.

PV of Costs = -$15,000 x (P/A,5%,1%,12).
PV of Costs = -$15,000 x (P/A,$i^O$,12)/(1+5%)

i^O = (1 + i)/(1 + g) - 1 = 1.01/1.05 - 1 = -3.81%

PV of Costs = -$15,000 x (P/A,-3.81%,12)/1.05
PV of Costs = -$15,000 x 15.59/1.05 = -$222,649.24

(I used full precision in Excel to obtain the final value - your numbers will vary if you use the rounded -3.81% and 15.59 written above.)

The monthly instalments are an annuity with A to be determined, i=1%, N = 6, and the first payment in month 13. That means that using (P/A,i%,6) will return a Year 12 value, and we will need to use (P/F,1%,12) to obtain the present value.

PV of instalments = A x (P/A,1%,6) x (P/F,1%,12)
PV of instalments = A x 5.80 x 0.89 = A x 5.14 (rounded)

Solving for A:

-$222,649.24 + A x 5.14 = 0
A = $222,649.24/5.14 = $43,290.10

Chapter 4

4.11

Let's go item by item and annualize them, then add them up. MARR = 12%

Hydraulic Press:
N = 15
Initial Cost: -$275,000 x (A/P,12%,15) = -$40,376.67
Annual Savings: +$33,000
Annual Maintenance Costs:
Growth-adjusted interest rate i^o: (1+12%)/(1+15%) – 1 = -2.6% (approx.)
-$2,000 x (P/A,-2.6%,15)/(1 + 15%) x (A/P,12%,15) = -$4,763.08
Salvage: +$19,250 x (A/F,12%,15) = $516.37
Total AW: -$40,376.67 + $33,000 - $4,763.08 + $516.37 = -$11,623.38

Moulding Press:
N = 10
Initial Cost: -$185,000 x (A/P,12%,10) = -$32,742.07
Annual Savings: +$24,500
Maintenance Costs: -$1,000 - $350 x (A/G,12%,10) = $1,000 - $1,254.63 = -$2,254.63
Salvage: +$14,800 x (A/F,12%,10) = $843.37
Total AW: -$32,742.07 + $24,500 - $2,254.63 + $843.37 = -$9,653.33

Assuming it must buy one, Moulding Press, since it has the lowest cost in AW terms (but neither of them, on their own, is a good investment).

<u>Chapter 5</u>

5.19 The projects are mislabeled in the solution. (P1,P2,P3) should be (P2,P3,P1) respectively.

<u>Chapter 7</u>

7.14

The publisher's solution has a typo in its year 4 calculations. The economic lifetime of the car is 4 years, as shown in the table below:

Year (N)	Costs	PV	Cum. PV Costs	Salvage	PV Salvage	Total PV	EAC
0	$15,000	$15,000.00	$15,000.00	$15,000	$15,000.00		
1		$0.00	$15,000.00	$10,500	$9,722.22	$5,277.78	$5,700.00
2		$0.00	$15,000.00	$7,350	$6,301.44	$8,698.56	$4,877.88
3	$1,500	$1,190.75	$16,190.75	$5,145	$4,084.27	$12,106.48	$4,697.72
4	$2,250	$1,653.82	$17,844.57	$3,601.50	$2,647.21	$15,197.36	$4,588.40
5	$3,375	$2,296.97	$20,141.53	$2,521.05	$1,715.78	$18,425.75	$4,614.85
	$	x(P/A,8%,N)	Sum 0 to N	d=0.3	x(P/A,8%,N)	Costs - S	x(A/P,8%,N)

Chapter 9

9.2

(a) $\$500 / (1 + 4\%)^3 = \$355.60$.
(b) After three years of inflation, \$400 becomes $\$400 \times (1 + 4\%)^3 = \$449.95$
(c) $\$10 / (1 + 4\%) = \$9.62$
(d) $\$350{,}983 \times (1 + 4\%)^{10} = \$237{,}111.54$
(e) $£1 \times (1 + 4\%)^{1000} = £1.08 \times 10^{17}$
(f) $\$1{,}000{,}000{,}000 / (1 + 4\%)^{300} = \$7{,}762.44$

9.3

Though not specified, from the existing solutions it seems a real interest rate of 4% is intended. That being the case, it'll be useful to calculate the nominal interest rate, so we can use it with all the nominal values. (We'll get the right result if we use real with real, or nominal with nominal.)

If r = real rate, i = nominal rate and f = inflation, then $r = (1 + i)/(1 + f) - 1$
$\rightarrow i = (1 + r) \times (1 + f) - 1 = 1.04 \times 1.04 - 1 = 8.16\%$

(a) F = \$400, N = 3, P = \$400 x (P/F, 8.16%, 3) = \$316.13
(b) P = \$400, N = 3, F = \$400 x (F/P, 8.16%, 3) = \$506.13
(c) F = \$10, N = 1, P = \$9.25 x (P/F, 8.16%, 1) = \$9.25
(d) F = \$350,983, N = 10, P = \$350,983 x (P/F, 8.16%, 10) = \$160,184.06
(e) P = £1, N = 1000, F = £1 x (F/P, 8.16%, 1000) = $£1.17 \times 10^{34}$
(f) F = \$1,000,000,000, N = 300, P = \$1,000,000,000 x (P/F, 8.16%, 300) = \$0.06

9.8 (a) If inflation is 4% a year, then something that costs \$1.59 today will cost $\$1.59 \times (1 + 4\%)^{50}$ in 50 years.

Since 1.04^{50} is about equal to 7.1067, this means the answer should be about \$11.30.

The publisher's answer up to the final number is correct, but they used 100 years instead of 50 years in their calculation.

9.10 The REAL interest rate is 5% per year. Knowing this, the publisher's solutions follow.

9.16 There's a typo in the textbook question. It mentions the base years as 2005 and 2015 as the base years, while 2002 and 2012 are listed in the table column titles. The two columns should be labeled 'Price Index 2005 Base' and 'Price Index 2015 Base', instead.

The solution then becomes the following:

2005 Base Price Index in 2013 = 125

2005 Base Price Index in 2016 = ???
2015 Base Price Index in 2015 = 100
2015 Base Price Index in 2016 = 110
→Price index in 2016 is 1.1 x Price index in 2015, no matter what the base year is.

2005 Base Price Index in 2015 = 130
→ 2005 Base Price Index in 2016 = 1.1 x 130 = 143

→2005 Base Price Index went from 125 in 2013 to 143 in 2016.
→Cost of our basket rose by a factor of 143/125 = 1.144
→Total inflation over the period was 14.4%.
(i.e. A widget that cost $100 in 2013 would costs $100 x (1 + 0.144) = $114.40 in 2016.)

This is the same answer as in the publisher's solution.

9.18

Note that the publisher assumes the first income and maintenance costs of the reservoir are in Year 1, though it doesn't list it in the question. I'll follow that convention.

The publisher's solution multiplies by $(1 + f)^n$, where it should divide by it.

You have nominal cash flows and a real interest rate. To find the present value, you must use either nominal cash flows and a nominal interest rate, or real cash flows and the real interest rate. The textbook asks you to do the latter in two steps.

(a) Convert nominal cash flows at time N to real cash flows at time N using (P/F,f,N), where f is the rate of inflation. In this case, f = 3%, so we use (P/F,3%,N) = $1/1.03^N$.

(b) Convert real cash flows at time N to present values at time 0 using (P/F,r,N), where r is the real interest rate. In this case, r = 4%, so we use (P/F,4%,N) = $1/1.04^N$.

(c) Find out whether the project is worthwhile. Adding up the present worths in the table below, we see the project is, indeed, worthwhile, since the present worth is \$9,918 > 0.

Year (N)	Nominal F	(P/F,3%,N)	Real F (f = 3%)	(P/F,4%,N)	PV
0	-\$200,000	1.0000	-\$200,000	1.0000	-\$200,000
1	\$20,000	0.9709	\$19,417	0.9615	\$18,671
2	\$20,000	0.9426	\$18,852	0.9246	\$17,430
3	\$20,000	0.9151	\$18,303	0.8890	\$16,271
4	\$20,000	0.8885	\$17,770	0.8548	\$15,190
5	\$20,000	0.8626	\$17,252	0.8219	\$14,180
6	\$20,000	0.8375	\$16,750	0.7903	\$13,238
7	\$20,000	0.8131	\$16,262	0.7599	\$12,358
8	\$20,000	0.7894	\$15,788	0.7307	\$11,536
9	\$20,000	0.7664	\$15,328	0.7026	\$10,769
10	\$20,000	0.7441	\$14,882	0.6756	\$10,054
11	\$20,000	0.7224	\$14,448	0.6496	\$9,385
12	\$20,000	0.7014	\$14,028	0.6246	\$8,762
13	\$20,000	0.6810	\$13,619	0.6006	\$8,179
14	\$20,000	0.6611	\$13,222	0.5775	\$7,636
15	\$20,000	0.6419	\$12,837	0.5553	\$7,128
16	\$20,000	0.6232	\$12,463	0.5339	\$6,654
17	\$20,000	0.6050	\$12,100	0.5134	\$6,212
18	\$20,000	0.5874	\$11,748	0.4936	\$5,799
19	\$20,000	0.5703	\$11,406	0.4746	\$5,414
20	\$20,000	0.5537	\$11,074	0.4564	\$5,054
				TOTAL	**\$9,918**

This is the ‘brute force’ way to do it, though. There is a more elegant way.

We have mostly nominal cash flows, so let's use a nominal interest rate. The real interest rate is 4%, and inflation is 3%, so the nominal interest rate is

$i = (1 + r) \times (1 + f) - 1 = 1.04 \times 1.03 - 1 = 7.12\%$.

Now we only have two factors to consider.

Initial payment of $200,000: this is already in present value terms. P = -$200,000
Annual net income of $22,000 - $2,000 = $20,000 from Year 1 to Year 20. This is an annuity with A = $20,000 and N = 20.

Total present value:

PV = -200,000 + 20,000 x (P/A,7.12%,20) = -200,000 + 20,000 x 10.4959
PV = -200,000 + $209,918 = **$9,918**, just as before.

Since 'nominal cash flows and interest rates' and 'real cash flows and interest rates' both work, you should decide which method to use based on what makes your life easier. In this case, there were 20 years of nominal cash flows, and only one real value, the interest rate, so it saved us a lot of time to work with everything in nominal terms.

Chapter 10

10.4.b

Modified Benefit-Cost Ratio = (Benefits – O/M Costs)/Capital Costs

Project A: (19 – 5)/5 = 2.8
Project B: (15 – 8)/1 = 7

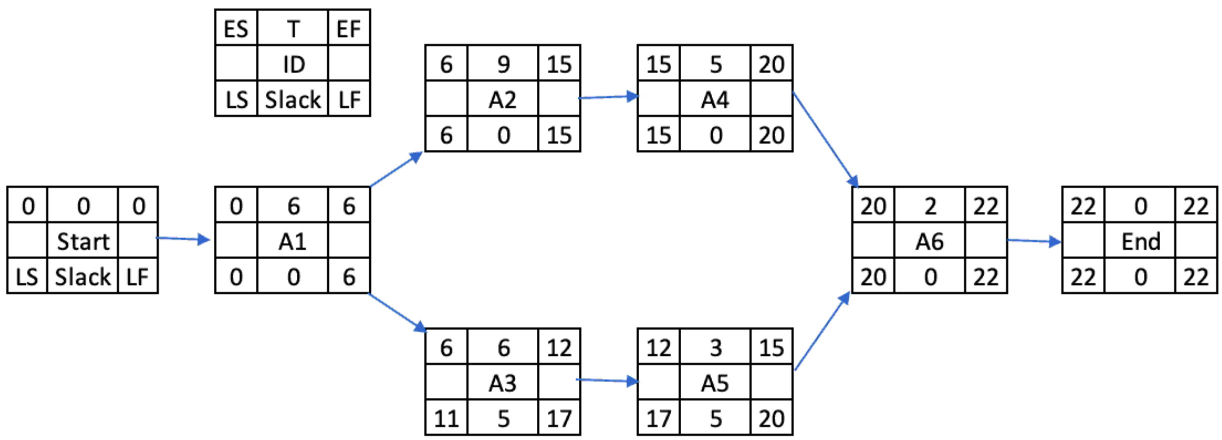
Chapter 11

Textbook Table 11.4, p. 400

Activity 7 should only have 4 as a predecessor, as in Figure 11.9 on the following page.

11.18

(a)



(b) A3 has only A1 as a predecessor. A1 has an early finish time of 6, so that's the earliest that A3 can start.

(c) A1 has A2 and A3 as successors. A2 has a late start time of 6, A3 has a late start time of 11. In order for both of these to start by their late start time, A1 must finish by time period 6 at the latest (=MIN(6,11)).

(d) Activities 1,2,4 and 6 – that is, the activities with Slack 0.

(e) 22 weeks (finish time for End node)

11.23

The ‘Normal Cost’ and ‘Crash Cost’ columns have been flipped in the question. The ‘Crash Cost’ column must have higher numbers than the ‘Normal Cost’ columns, since crashing imposes additional costs. Once the columns are switched, the publisher solution is correct.

11.24

The predecessor information given in the question is incorrect. They should be

Activity	Predecessor
1	-
2	1
3	-
4	3
5	2,3
6	4,5
7	6

Once this correction is made, the publisher solution is correct (note that costs in the table are in thousands of dollars, not dollars).

<u>Chapter 12</u>

12.11

To find the expected value for ‘No. of Defects’, multiply each possible value of ‘No. of Defects’ by its corresponding probability, then add those values together:

A1			X1000		
No. of Defects	Probability	No. x Prob	No. of Defects	Probability	No. x Prob
0	0.36	0	0	0.25	0
1	0.28	0.28	1	0.33	0.33
2	0.15	0.3	2	0.26	0.52
3	0.15	0.45	3	0.16	0.48
4	0.16	0.64	4	0.05	0.2
5	0.02	0.1	5	0.01	0.05
E(No. of Defects)		1.77	E (No. of Defects)		1.58

Since the expected defects are lower for X1000 (1.58 < 1.77), X1000 is preferred.

12.15

The probabilities of slow, steady and rapid growth are missing. They are as follows:

Rapid Growth: 30%
Steady Growth: 40%
Slow Growth: 30%

With these probabilities taken into account, the publisher’s solution is correct.