ENGINEERING ECONOMICS ISE460
SESSION 5
CHAPTER 3 continued, June 3, 2011

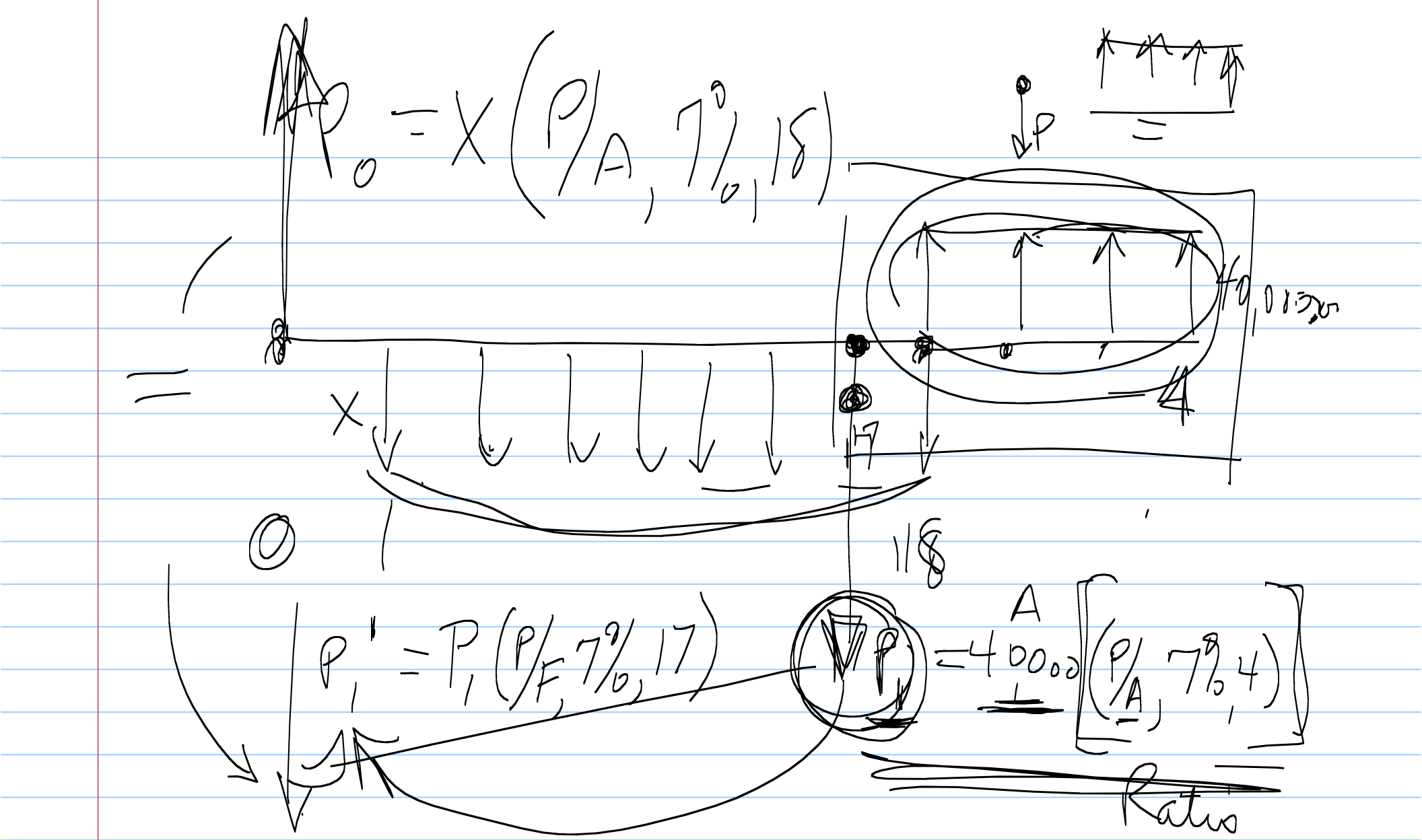
OUTLINE

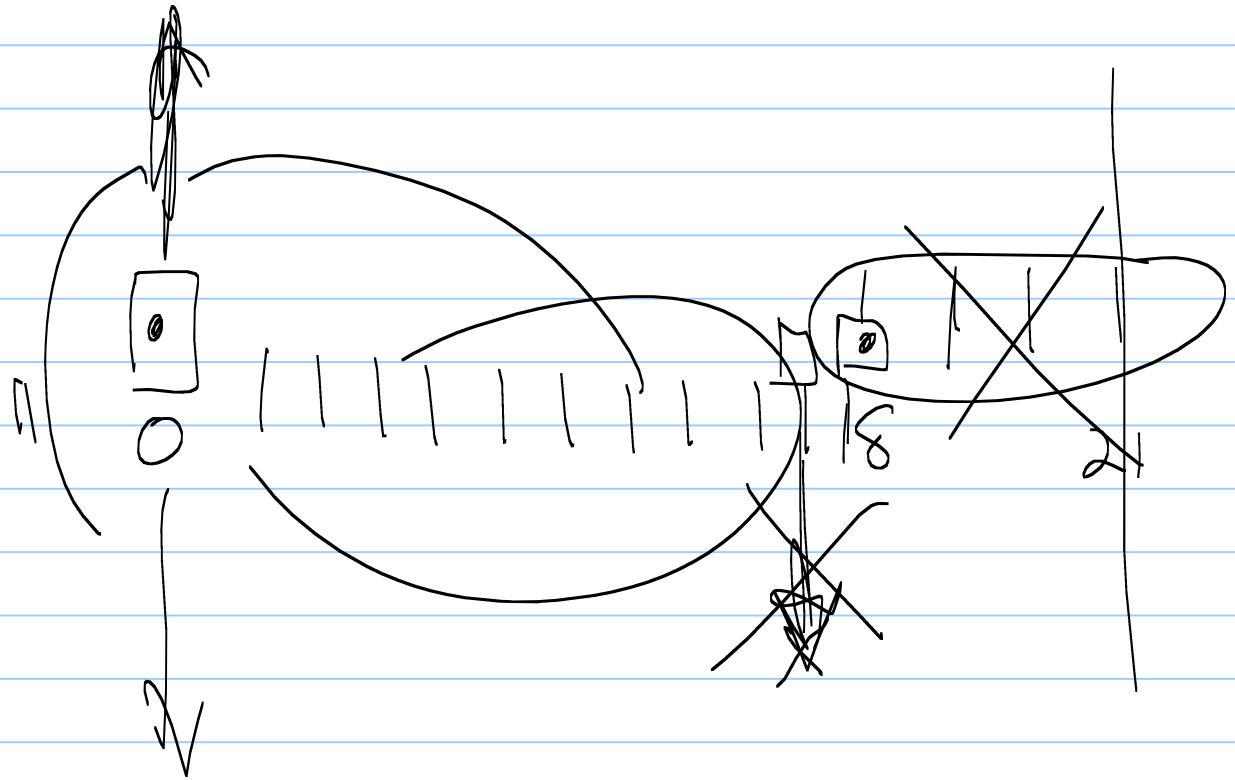
- **QUESTIONS?**
- **News?**
  - **See links page for David Brooks editorial**
- **Florence 1944**
- **CHAPTER 3 – continued**
- **Questionnaire results**
- **Grades on line – use the website**
- **Private Functions in Excel**

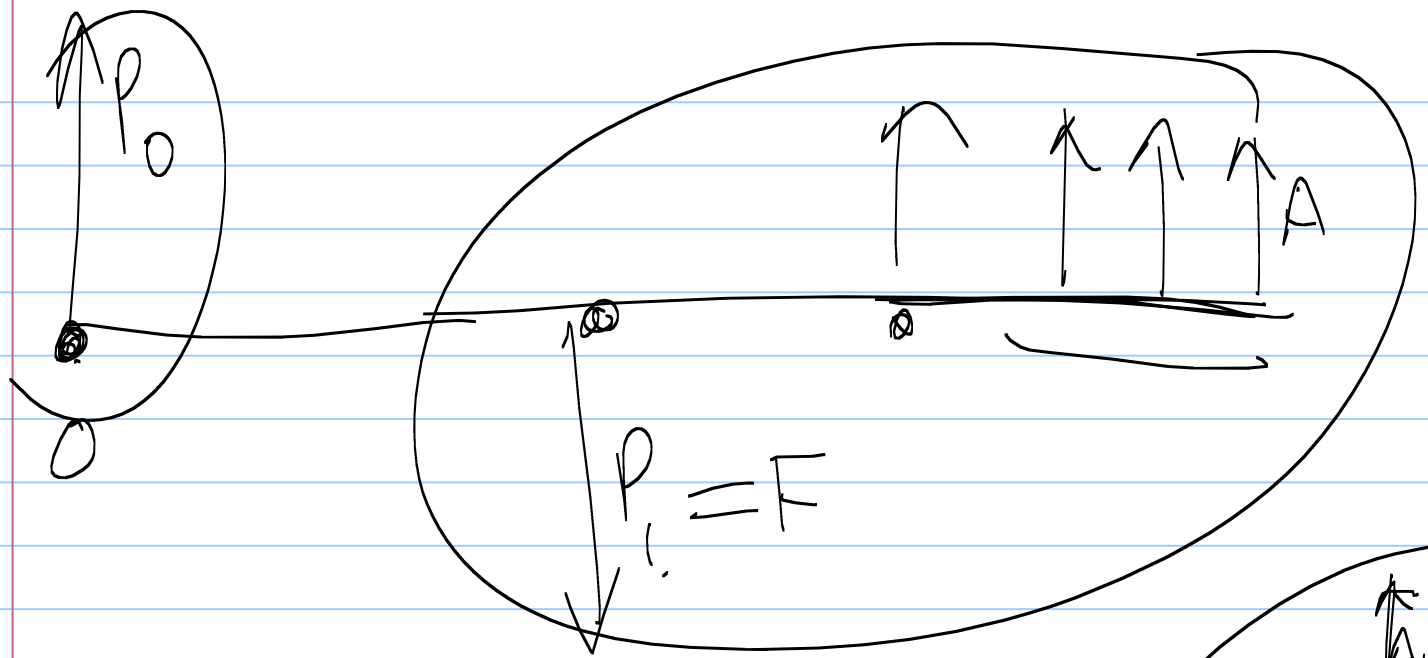
2 questions
David motion
resolution
Engineering Cohort

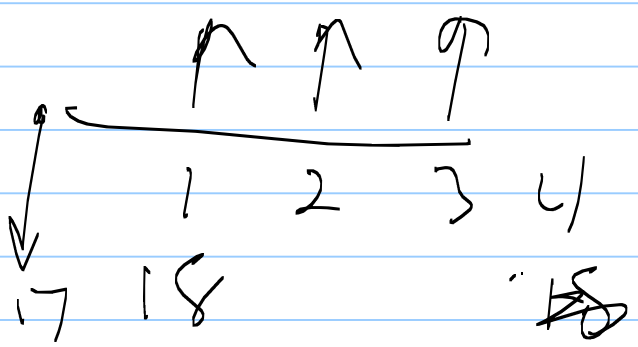
Photos from "An Art City at War"

The Ponte Vecchio (Florence) - the only bridge left standing by the retreating German army as Florence is taken by the 8th Army in August 1944.


$P_0 = X\left(P/A, 7\%, 18\right)$
P
X
17
18
$P_1' = P_1\left(P/F, 7\%, 17\right)$
$P_1 = 40000\left[\left(P/A, 7\%, 4\right)\right]$
A
Ratio

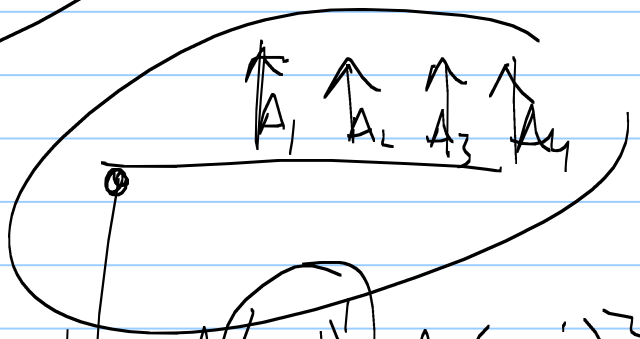

0
18
24





17 18 ~~19~~

P/A



$V = A_1(1+i)^1 + A_2(1+i)^2 + \dots$

$= P/F(7\%,1) + 2 \quad 3$

Example 3.27

EXAMPLE 3.27 Calculating an Unknown Interest Rate with Multiple Factors

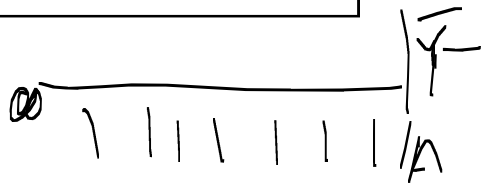
You may have already won $2 million! Just peel the game piece off the Instant Winner Sweepstakes ticket, and mail it to us along with your order for subscriptions to your two favorite magazines. As a grand prize winner, you may choose between a $1 million cash prize paid immediately or $100,000 per year for 20 years—that's $2 million! Suppose that, instead of receiving one lump sum of $1 million, you decide to accept the 20 annual installments of $100,000. If you are like most jackpot winners, you will be tempted to spend your winnings to improve your lifestyle during the first several years. Only after you get this type of spending "out of your system" will you save later sums for investment purposes. Suppose that you are considering the following two options:

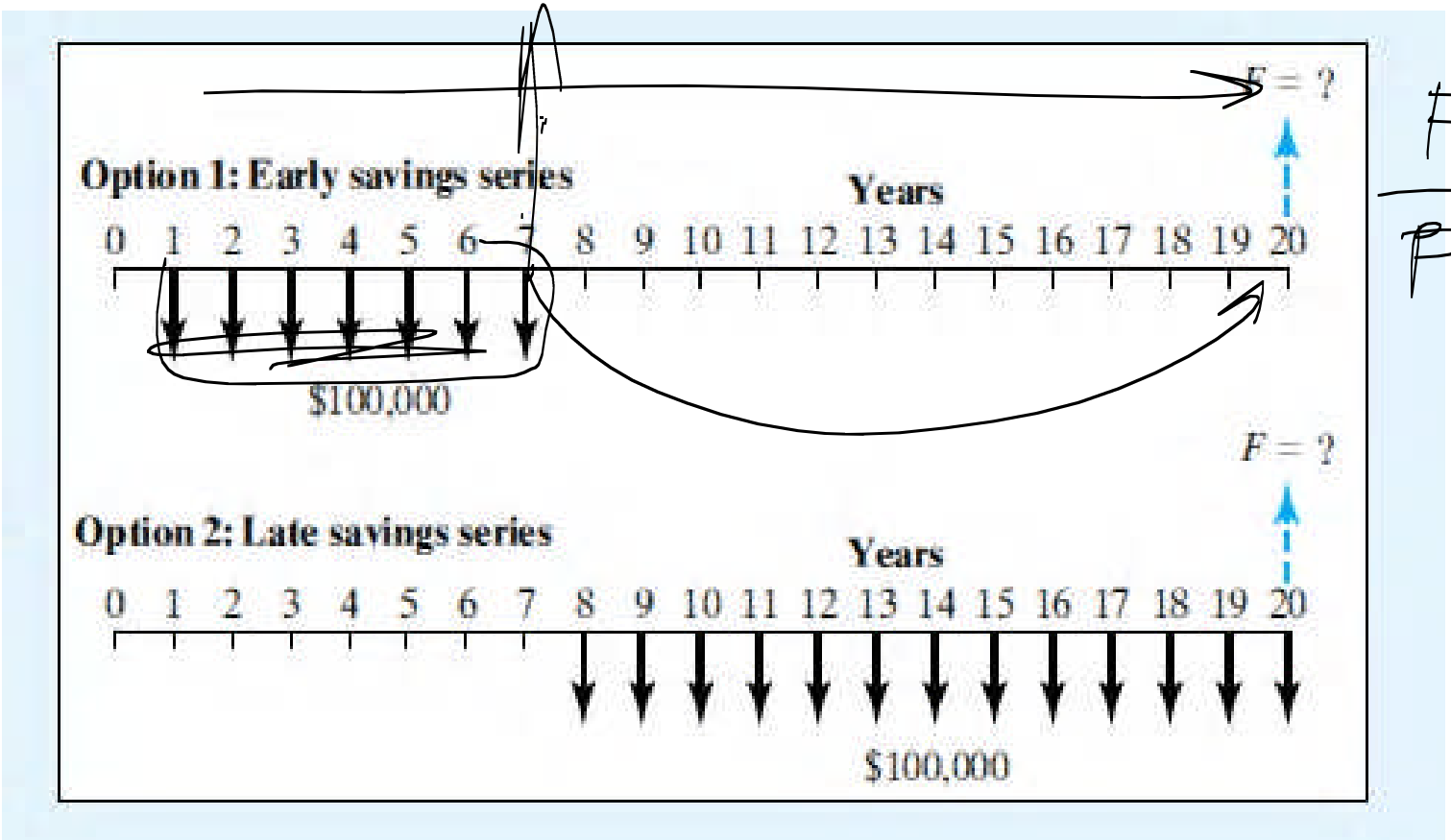
Option 1: You save your winnings for the first 7 years and then spend every cent of the winnings in the remaining 13 years.

Option 2: You do the reverse, spending for 7 years and then saving for 13 years.

If you can save winnings at 7% interest, how much would you have at the end of 20 years, and what interest rate on your savings will make these two options equivalent? (Cash flows into savings for the two options are shown in Figure 3.41.)

3.27 – cash flows





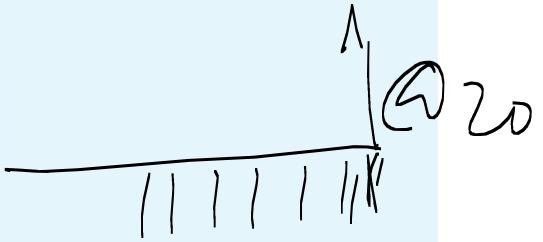
3.27 – part a)

$$F_{\text{Option 1}} = \$100{,}000(F/A, 7\%, 7)(F/P, 7\%, 13)$$

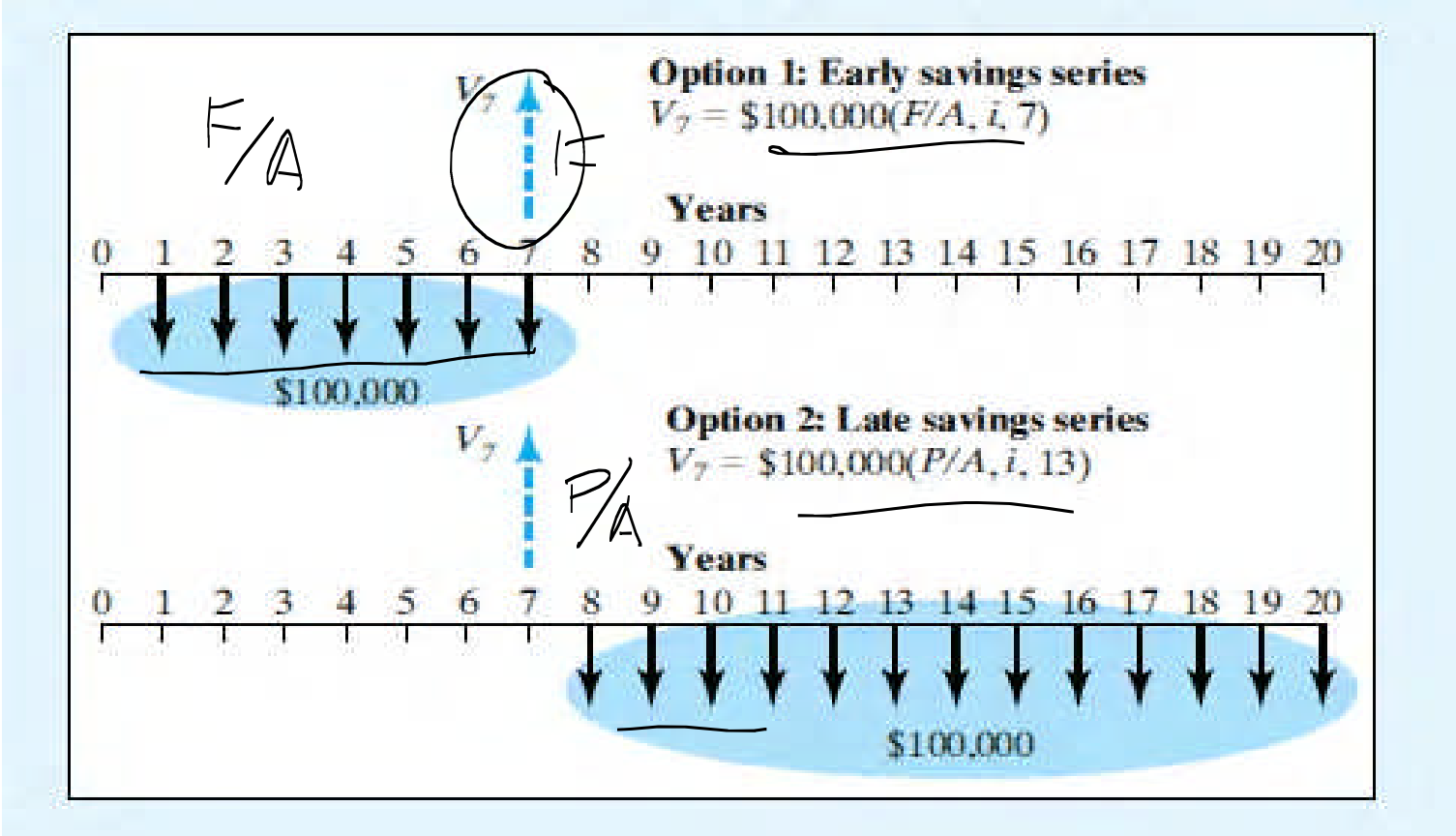
$$= \$2{,}085{,}485;$$

$$F_{\text{Option 2}} = \$100{,}000(F/A, 7\%, 13)$$

$$= \$2{,}014{,}064.$$



3.27 part b)


Option 1: Early savings series
$V_7 = \$100{,}000(F/A, i, 7)$
F/A
V_7
i=?
Years
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
$100,000
Option 2: Late savings series
$V_7 = \$100{,}000(P/A, i, 13)$
P/A
V_7
Years
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
$100,000

3.27 part b)

- For Option 1,

$$V_7 = \$100{,}000(F/A, i, 7).$$

- For Option 2,

$$V_7 = \$100{,}000(P/A, i, 13).$$

We equate the two values:

$$\$100{,}000(F/A, i, 7) = \$100{,}000(P/A, i, 13);$$

$$\frac{(F/A, i, 7)}{(P/A, i, 13)} = 1.$$

3.27 part b)

Here, we are looking for an interest rate that gives a ratio of unity. When using the interest tables, we need to resort to a trial-and-error method. Suppose that we guess the interest rate to be 6%. Then

$$\frac{(F/A, 6\%, 7)}{(P/A, 6\%, 13)} = \frac{8.3938}{8.8527} = 0.9482.$$

This is less than unity. To increase the ratio, we need to use a value of i such that it increases the $(F/A, i, 7)$ factor value, but decreases the $(P/A, i, 13)$ value. This will happen if we use a larger interest rate. Let's try $i = 7\%$:

$$\frac{(F/A, 7\%, 7)}{(P/A, 7\%, 13)} = \frac{8.6540}{8.3577} = 1.0355.$$

Now the ratio is greater than unity.

Interest Rate	(F/A, i, 7)/(P/A, i, 13)
6%	0.9482
?	1.0000
7%	1.0355

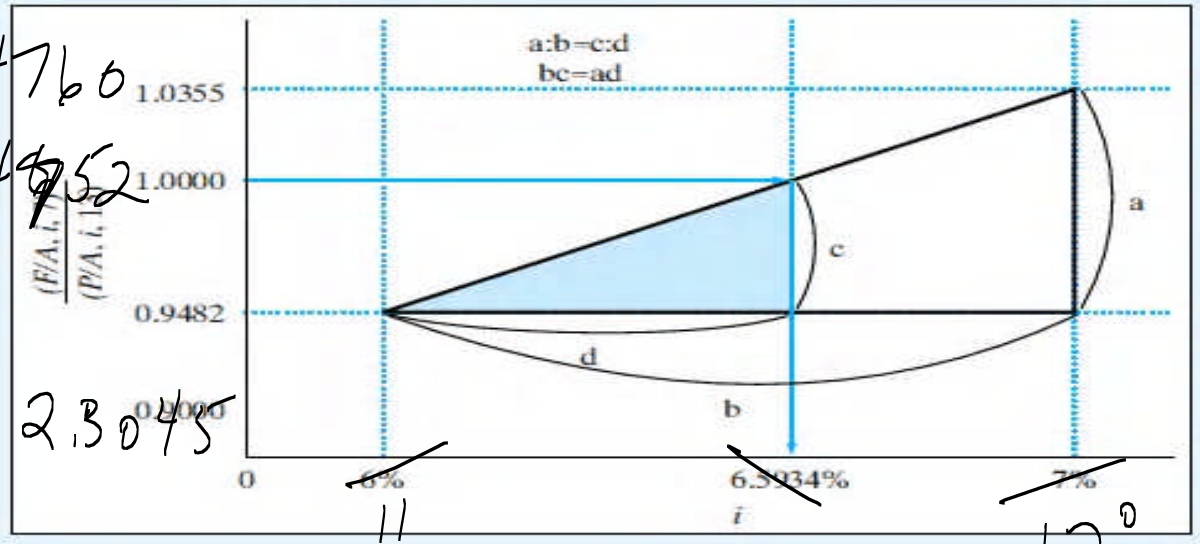
3.27 part b)

As a result, we find that the interest rate is between 6% and 7% and may be approximated by **linear** interpolation as shown in Figure 3.43:

$$i = 6\% + (7\% - 6\%)\left[\frac{1 - 0.9482}{1.0355 - 0.9482}\right]$$
$$= 6\% + 1\%\left[\frac{0.0518}{0.0873}\right]$$
$$= 6.5934\%.$$

11% + 1% (2,4752 - 2,3045) / (2,4760 - 2,3045)
= 11,99%

2,4760
2,4752
2,3045



11
12%

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	ISE460 SP01	ISE460 F01	ISE460 SP02	ISE460 SP03	ISE460 F05	ISE460 F06	ISE460 F07	ISE460 SP08	ISE460 SU08	ISE461 F08	ISE460 SP09	ISE460 SU09	ISE460 F09	ISE460 SP10	ISE460 SU10	ISE460 SU11	Average	Average SU
Number of respondents	27	38	23	27	60	114	104	89	19.0	91	95	20.0	141	83	20.0	22.0	60.8	20.3
Per cent of class	90%	83%	100%	96%	41%	82%	72%	73%	100%	75%	90%	100%	95%	104%	100%	100%	88%	100%
Spreadsheet users	93%	97%	78%	81%	88%	88%	95%	93%	95%	91%	92%	90%	89%	95%	95%	91%	91%	92%
Excel	100%	95%	100%	100%	100%			100%									99%	
Other	Lotus	Quatro																
Excel Expertise (1-expert to 5 no exp.)	3.67	3.07	3.43	3.30	2.88	2.98	2.97	2.93	2.94	2.97	2.99	2.65	2.99	3.07	2.90	2.55	3.02	2.71
Hours of study, average	4.0	4.4	4.2	3.3	6.1	5.4	6.1	5.7	6.7	5.9	5.1	6.4	5.6	4.8	5.9	7.1	5.4	6.7
Max	9.0	20.0	9.0	10.0	15.0	25.0	30.0	16.0	14.0	20.0	15.0	10.0	15.0	12.5	12.0	12.0	15.3	12.0
Min	0	2	2	1	2	1	1	2	2.0	1.5	1	3.0	1	1.5	3.0	2.5	1.7	2.5
Median	4	3	3.5	2.9	5.3	5	5	6	6.0	5	5	6.0	5	4	5.8	6.8	4.9	6.3
Std. Dev.	2.3	3.3	1.8	2.2	2.9	3.5	4.2	2.8	3.3	3.0	2.5	2.2	2.9	2.3	2.1	2.8	2.7	2.8
Computer Owners	96%	92%	92%	96%	100%	96%	93%	93%	95%	98%	96%	90%	98%	94%	100%	100%	96%	95%
% Laptops				42%	43%	78%	84%	90%	100%	89%	92%	100%	93%	95%	100%	100%	85%	100%
% Female	22%	34%	34%	33%	13%	22%	22%	12%	43%	19%	17%	50%	24%	12%	30%	45%	27%	46%
Age, average	21.1	21.5	21.8	22.1	27.6	23.6	24.4	25.3	21.9	23.7	23.5	20.4	24.7	23.3	20.5	20.7	22.9	21.0
Median	20.7	21.2	21.8	21.6	25.4	21.8	22.5	23.8	21.5	21.8	22.0	20.4	22.4	22.2	20.3	20.5	21.9	20.8
Std. Dev.	1.58	1.57	1.41	2.1	7	5.6	5.7	5.8	0.80	5.1	4.9	0.60	9.2	3.6	0.70	1.30	3.56	0.9
Operating System																		
Mac	4%	0%	5%	0%	7%	10%	16%	10%	33%	11%	20%	50%	25%	26%	25%	55%	19%	46%
Windows XP or Vista	19%			46%	88%	90%	84%	90%	67%	89%	80%	50%	83%	86%	80%	55%	72%	57%
Different States/Countries	16	22	15	12	27	43	40	32	8.0	35	33	11.0	51	36	10.0	12.0	25.2	10.3
Programming experience	85%	87%	91%	78%	43%	78%	79%	75%	89%	73%	79%	95%	67%	84%	80%	91%	80%	92%
GPA	3.01	3.18	3.10	3.09	3.13	3.18	3.37	3.09	3.94	3.35	3.11	3.73	3.24	3.20	3.90		3.31	3.84