第 1 題  Calculating Annuities Due  （第 4 章，#51，123 頁）

You want to lease a set of golf clubs from Hook N Shank. The lease contract is in the form of 24 equal monthly payments at a 12 percent stated annual interest rate, compounded monthly. Because the clubs cost $4,000 retail, Hook N Shank wants the PV of the lease payments to equal $4,000. Suppose that your first payment is due immediately. What will your monthly lease payments be?

【分析】
分期付款，求年金。

\[ n = 24, \quad r = \frac{12\%}{12} = 1\%, \quad PV = 4,000 \] （現在付第一期）

\[ A \times PVIFA_{1\%,24} = PV \times PVIF_{1\%,1} \quad \Rightarrow \quad A = PV \times \frac{PVIF_{1\%,1}}{PVIFA_{1\%,24}} = 186.43 \]

\[ r = 1.00\% \quad n = 24 \quad PV = 4,000 \]

\[ A = \$186.43 \]

第 2 題  Calculating Annuities  （第 4 章，#54，124 頁）

You have recently won the super jackpot in the Washington State Lottery. On reading the fine print, you discover that you have the following two options:

a. You will receive 31 annual payments of $160,000, with the first payment being delivered today. The income will be taxed at a rate of 28 percent. Taxes will be withheld when the checks are issued.

b. You will receive $446,000 now, and you will not have to pay taxes on this amount. In addition, beginning one year from today, you will receive $101,055 each year for 30 years. The cash flows from this annuity will be taxed at 28 percent.

Using a discount rate of 10 percent, which option should you select?

【分析】
兩種付款方式，比較現值。

(a)  \[ P_0 = 160,000 \times (1 - T), \quad r = 10\%, \quad n = 30, \quad A = 160,000, \quad T = 28\% \]  
(b)  \[ P_0 = 446,000, \quad r = 10\%, \quad n = 30, \quad A = 101,055, \quad T = 28\% \]

\[ PV = P_0 + A \times (1 - T) \times PVIFA_{r, n} \]

\[ r = 10\% \quad n = 30 \quad T = 28\% \]

<table>
<thead>
<tr>
<th>Option</th>
<th>Payment</th>
<th>Tax Rate</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>$160,000</td>
<td>28%</td>
<td>$160,000</td>
</tr>
<tr>
<td>(b)</td>
<td>$446,000</td>
<td>28%</td>
<td>$446,000</td>
</tr>
</tbody>
</table>
第3题  Balloon Payments  （第4章，#56，124页）
On September 1, 2004, Tsing Chao bought a motorcycle for CNY 15,000. She paid CNY 1,000 down and financed the balance with a five-year loan at a stated annual interest rate of 9.6 percent, compounded monthly. She started the monthly payments exactly one month after the purchase (i.e., October 1, 2004). Two years later, at the end of October 2006, Tsing got a new job and decided to pay off the loan. If the bank charges her a 1 percent prepayment penalty based on the loan balance, how much must she pay the bank on November 1, 2006?

【分析】
借 \( PV = 15,000 - 1,000 \)，分12×5期付款，每期利率9.6%/12 = 0.8%。
付12×2期後，計畫一次清償欠款，違約金為欠款之1%。

\[
A = \frac{PV}{PVIFA_{0.8\%,60}} = 294.71
\]

2006年10月底已經付25期，11月1日需付第26期並清償未付的34期。

應付金額 = \( A\times[PVIFA_{0.8\%,34}]\times(1+1\%)\) = 9,124.76

第4题  Discount Interest Loans  （第4章，#60，125页）
This question illustrates what is known as discount interest. Imagine you are discussing a loan with a somewhat unscrupulous lender. You want to borrow £20,000 for one year. The interest rate is 12 percent—you and the lender agree that the interest on the loan will be \( 0.12 \times £20,000 = £2,400 \). So, the lender deducts this interest amount from the loan up front and gives you £17,600. In this case, we say that the discount is £2,400. What's wrong here?

【分析】
利息先從借款金額中扣除。
今天實際拿到 \( PV = 20,000 - 2,400 \)，一年後償付 \( FV = 20,000 \)；
假設真實利率為 \( r \)，則

\[
PV\times(1+r) = FV \quad \Rightarrow \quad 17,600\times(1+r) = 20,000 \quad \Rightarrow \quad r = 13.64\%
\]

真實利息是13.64%，不是宣稱的12%。
第5题  Calculating EAR with Add-On Interest （第4章，#64，125页）

This problem illustrates a deceptive way of quoting interest rates called add-on interest. Imagine that you see an advertisement for Crazy Qun's Stereo City that reads something like this: “CNY 1,000 Instant Credit! 15% Simple Interest! Three Years to Pay! Low, Low Monthly Payments!” You’re not exactly sure what all this means and somebody has spilled ink over the APR on the loan contract, so you ask the manager for clarification.

Qun explains that if you borrow CNY 1,000 for three years at 15 percent interest, in three years you will owe:

\[ CNY 1,000 \times 1.15^3 = CNY 1,000 \times 1.52088 = CNY 1,520.88 \]

Qun recognizes that coming up with CNY 1,520.88 all at once might be a strain, so he lets you make “low, low monthly payments” of CNY 1,520.88/36 = CNY 42.25 per month. Even though this is extra bookkeeping work for him.

Is this a 15 percent loan? Why or why not? What is the APR on this loan? What is the EAR?
Why do you think this is called add-on interest?

【分析】

欠款 \( PV = 1,000 \) 、期付 \( A = 42.25 \) 、總共期數 \( n = 36 \)

\[
PV = A \times PVIFA(r, n = 36), \quad APR = 12 \times r, \quad ERA = (1 + APR/12)^{12} - 1
\]

\[
A = 42.25 \quad n = 36 \quad PV = 1,000
\]

\[
r = 2.47\% \quad APR = 29.63\% \quad EAR = 34.01\%
\]
第 6 题  Calculating Annuity Payments  （第 4 章，#65，126 頁）

This is a classic retirement problem. A time line will help in solving it. Your friend is celebrating her 35th birthday today and wants to start saving for her anticipated retirement at age 65. She wants to be able to withdraw £90,000 from her savings account on each birthday for 15 years following her retirement; the first withdrawal will be on her 66th birthday. Your friend intends to invest her money in the local credit union, which offers 8 percent interest per year. She wants to make equal annual payments on each birthday into the account established at the credit union for her retirement fund.

a. If she starts making these deposits on her 36th birthday and continues to make deposits until she is 65 (the last deposit will be on her 65th birthday), what amount must she deposit annually to be able to make the desired withdrawals at retirement?

b. Suppose your friend has just inherited a large sum of money. Rather than making equal annual payments, she has decided to make one lump-sum payment on her 35th birthday to cover her retirement needs. What amount does she have to deposit?

c. Suppose your friend's employer will contribute £1,500 to the account every year as part of the company’s profit-sharing plan. In addition, your friend expects a £25,000 distribution from a family trust fund on her 55th birthday, which she will also put into the retirement account. What amount must she deposit annually now to be able to make the desired withdrawals at retirement?

【分析】

需要金額（65 歲生日時）：每年提領 A = 90,000，共 n = 15 年。（r = 8%）

\[ FV_{65} = A \times PVIFA(r = 8\%, n = 15) \]

資金來源：

(a) 年存金額 A，共存 n = 65 − 35 年。（r = 8%）

\[ A_1 \times PVIFA(r = 8\%, n = 30) = FV_{65} \times PVIF(r = 8\%, n = 30) \]

(b) 現在一次提存。

\[ PV_{35} = FV_{65} \times PVIF(r = 8\%, n = 30) \]

(c) 年存金額 A₂，雇主年補助 A₃ = 1,500，55 歲時收到 P₅₅ = 25,000。

\[ (A_2 + A_3) \times PVIFA(r = 8\%, n = 30) + P_{55} \times PVIF(r = 8\%, n = 20) \]

\[ = FV_{65} \times PVIF(r = 8\%, n = 30) \]

\[
\begin{align*}
A &= 90,000 & n &= 15 & r &= 8\% & n2 &= 30 \\
A1 &= 1,500 & P55 &= 25,000 & A3 &= 1,500 & n3 &= 20 \\
A1 &= 6,800.24 & FV35 &= 76,555.63 & A2 &= 4,823.80
\end{align*}
\]
第 7 題  Annuity Present Values and Effective Rates  （第 4 章，#68，126 頁）

You have just won the lottery. You will receive £1,000,000 today and then receive 40 payments of £500,000. These payments will start one year from now and will be paid every six months. A representative from Get Rich Now has offered to purchase all the payments from you for £10 million. If the appropriate interest rate is a 9 percent APR compounded daily, should you rake the offer? Assume there are 12 months in a year, each with 30 days.

【分析】

中獎得到現金流量: 現在拿 \( P_0 = 1,000,000 \)，半年拿 \( A_i = 500,000 \)，共 \( n = 40 \) 期。

中獎金額現值  \( PV = P_0 + A_i \times PVIFA_{i,40} \times PVIF_{i,1} \)

折現率由以下公式求。已知年利率 \( APR = 9\% \)，每日複利：

半年有效利率  \( r_1 = \left(1 + \frac{9\%}{360}\right)^{180} - 1 \)

收購價為 10,000,000，若 \( PV < 10,000,000 \) 就值得出售。

\[
\begin{align*}
A_1 &= \$500,000 \\
P_0 &= \$1,000,000 \\
n &= 40 \\
r &= 9\% \\
r_1 &= 4.60\% \\
PV &= \$9,669,131
\end{align*}
\]
第 8 题  Components of Bond Returns  （第 5 章，#32，157 頁）

Bond P is a premium bond with a 10 percent coupon. Bond D is a 6 percent coupon bond currently selling at a discount. Both bonds make annual payments, have a YTM of 8 percent, and have five years to maturity. What is the current yield for Bond P? For Bond D? If interest rates remain unchanged, what is the expected capital gains yield over the next year for Bond P? For Bond D? Explain your answers and the interrelationship among the various types of yields.

【分析】

公司債的價格：

\[
P^P = 100 \times PVIFA_{8\%,5} + 1,000 \times PVIF_{8\%,5} \]
\[
P^D = 60 \times PVIFA_{8\%,5} + 1,000 \times PVIF_{8\%,5} \]

\[
0.08,5,0 \times PVIFA_{5\%,4} + 1,000 \times PVIF_{5\%,4} \]
\[
0.08,5,0 \times PVIFA_{5\%,4} + 1,000 \times PVIF_{5\%,4} \]

yield = 利息/成本（公司債價值）= \[100/P^P \text{ or } 60/P^D\]

capital gain yield = \[P^P - P^D / P^P \text{ or } P^D / P^P\]

\[
r^P = 10\% \quad r^D = 6\% \quad n = 5 \quad r = 8\% \]
\[
P^P = \$1,000 \quad P^D = \$1,000 \quad \text{yield} = 0.00\% \quad \text{CGyield} = 0.00\% \]

第 9 题  Valuing Bonds  （第 5 章，#34，158 頁）

The Mallory Corporation has two different bonds currently outstanding. Bond M has a face value of €20,000 and matures in 20 years. The bond makes no payments for the first six years, then pays €1,200 every six months over the subsequent eight years, and finally pays €1,500 every six months over the last six years. Bond N also has a face value of €20,000 and a maturity of 20 years: it makes no coupon payments over the life of the bond. If the required return on both these bonds is 10 percent compounded semiannually, what is the current price of Bond M? Of Bond N?

【分析】

\[
P^M = 1,200 \times PVIFA_{5\%,30} \times PVIF_{5\%,12} + 1,500 \times PVIFA_{5\%,30} \times PVIF_{5\%,28} + 20,000 \times PVIF_{5\%,40} \]
\[
P^N = 20,000 \times PVIF_{5\%,40} \]

\[
r = 5\% \quad n_1 = 12 \quad n_2 = 16 \quad n_3 = 12 \]
\[
\text{FV} = \$20,000 \quad A_1 = \$0 \quad A_2 = \$1,200 \quad A_3 = \$1,500 \]
\[
\text{PM} = \$13,474.20 \quad \text{PN} = \$2,840.91 \]
第 10 题  
NPV Valuation  （第 6 章，#26，195 頁。）

The Yurdone Corporation wants to set up a private cemetery business. According to the CFO, Barry M. Deep, business is “looking up.” As a result, the cemetery project will provide a net cash inflow of $50,000 for the firm during the first year, and the cash flows are projected to grow at a rate of 6 percent per year forever. The project requires an initial investment of $780,000.

a. If Yurdone requires a 13 percent return on such undertakings, should the cemetery business be started?

b. The company is somewhat unsure about the assumption of a 6 percent growth rate in its cash flows. At what constant growth rate would the company just break even if it still required a 13 percent return on investment?

【分析】
這是一個永續成長年金的問題。

年金轉現值的公式如下：
\[
P = A \times \frac{1}{r - g} \left(1 - \left(\frac{1 + g}{1 + r}\right)^n\right)
\]

永續年金則如下：
\[
P = A \times \frac{1}{r - g}
\]

其中，A = $50,000, r = 13%, g = 6%, 期初投資：$780,000。

(a) 計算淨現值。
\[
NPV = -780,000 + 50,000 \times \frac{1}{13\% - 6\%} = -65,714.3 < 0
\]

(b) 計算損益平衡的收益成長率（g）。
\[
g = r - \frac{A}{P} = 13\% - \frac{50,000}{714,285.7} = 6.59\%
\]

A = $50,000  
P = $714,285.7  
g' = 6.59%
第 11 题  Calculating IRR （第 6 章，#27，195 頁。）

The Utah Mining Corporation is set to open a gold mine near Provo, Utah. According to the treasurer, Monty Goldstein, “This is a golden opportunity.” The mine will cost $600,000 to open and will have an economic life of 11 years. It will generate a cash inflow of $100,000 at the end of the first year, and the cash inflows are projected to grow at 8 percent per year for the next 10 years. After 11 years, the mine will be abandoned. Abandonment costs will be $50,000 at the end of year 11.

a. What is the IRR for the gold mine?

b. The Utah Mining Corporation requires a 10 percent return on such undertakings. Should the mine be opened?

【分析】
這個年限 n = 11 的投資機會。期初投資 \( P_0 = -$600,000 \) ，每年營收為 \( P_i = $100,000 \) 、\( P_i = P_{i-1} \times (1 + 8\%) \)，\( i = 1, \ldots, 10 \)；期末處理費用為 \( S_{11} = -$50,000 \)。

成長年金，求內部報酬率（IRR）。

\[
NPV = P_0 + \frac{P_1}{r - g} \times \left[ 1 - \left( \frac{1 + g}{1 + r} \right)^{11} \right] + S_{11} \times \frac{1}{(1 + r)^{11}}
\]

由 \( NPV = 0 \) 求得之 \( r \) 即為 IRR。

這題手算不好做，用 Excel 會比較簡單；直接用 IRR() 函數，或用『目標搜尋』工具皆可。

<table>
<thead>
<tr>
<th>年度</th>
<th>現金流量</th>
<th>P0 = -$600,000</th>
<th>P1 = $100,000</th>
<th>g = 8%</th>
<th>S11 = -$50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-$600,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$108,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$116,640</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$125,971</td>
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</tr>
<tr>
<td>5</td>
<td>$136,049</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td>$146,933</td>
<td></td>
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<tr>
<td>7</td>
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<tr>
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</tr>
<tr>
<td>9</td>
<td>$185,093</td>
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</tr>
<tr>
<td>10</td>
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<td></td>
</tr>
<tr>
<td>11</td>
<td>$165,892</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

IRR = 18.56%
Project Evaluation  （第 7 章，#30，223 頁。）
Birla Acoustics (BAI), Inc., projects unit sales for a new seven-octave voice emulation implant as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Unit Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85,000</td>
</tr>
<tr>
<td>2</td>
<td>98,000</td>
</tr>
<tr>
<td>3</td>
<td>106,000</td>
</tr>
<tr>
<td>4</td>
<td>114,000</td>
</tr>
<tr>
<td>5</td>
<td>93,000</td>
</tr>
</tbody>
</table>

Production of the implants will require $1,500,000 in net working capital to start and additional net working capital investments each year equal to 15 percent of the projected sales increase for the following year. Total fixed costs are $900,000 per year, variable production costs are $240 per unit, and the units are priced at $325 each. The equipment needed to begin production has an installed cost of $21,000,000. Because the implants are intended for professional singers, this equipment is considered industrial machinery and thus qualifies as seven-year MACRS property. In five years, this equipment can be sold for about 20 percent of its acquisition cost. BAI is in the 35 percent marginal tax bracket and has a required return on all its projects of 18 percent. Based on these preliminary project estimates, what is the NPV of the project? What is the IRR?

【分析】
投資年限 n=5，淨營運資金投資：第一年 $1,500,000，後續各年為年銷貨增量的 15%。每年營運費用：固定成本 $900,000，變動成本（每單位）$240，單位營收 $325。
期初投資金額 $21,000,000，殘值為投資金額之 20%。
折舊採修正加速成本收回法 (MACRS)，7 年耐用等級；公司稅率等級 35%。
可接受投資報酬率（折現率）18%。

<table>
<thead>
<tr>
<th>年次</th>
<th>3年</th>
<th>5年</th>
<th>7年</th>
<th>10年</th>
<th>15年</th>
<th>20年</th>
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<td>0.038</td>
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<td>0.066</td>
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<td>0.049</td>
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<td>10</td>
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<td>0.045</td>
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<tr>
<td>11</td>
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<td>0.059</td>
<td>0.045</td>
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</tr>
<tr>
<td>12~15</td>
<td>0.059</td>
<td>0.045</td>
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<tr>
<td>16</td>
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<td>0.045</td>
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<tr>
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<td>0.045</td>
<td></td>
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<tr>
<td>21</td>
<td>0.022</td>
<td></td>
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</tr>
</tbody>
</table>
**Single Price:** $325  
**Fixed Cost:** $900,000  
**Variable Cost:** $240  
**Initial Investment:** $21,000,000  
**Residual Value:** $4,200,000  
**Company Tax Rate:** 35%  

### Yearly Breakdown

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
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<td>0.143</td>
<td>$3,003,000</td>
<td>$17,997,000</td>
<td>85,000</td>
<td>$27,625,000</td>
<td>$21,300,000</td>
<td>$3,322,000</td>
<td>$1,162,700</td>
<td>$2,159,300</td>
<td>$5,162,300</td>
<td>$-1,500,000</td>
<td>$-21,000,000</td>
<td>$-22,500,000</td>
<td>18%</td>
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<td>15.47%</td>
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</tbody>
</table>

**Net Present Value (NPV):** $-1,242,154  
**Internal Rate of Return (IRR):** 15.47%

**Operating Cash Flow = Net Income + Depreciation**

期末設備處置收入 = 設備殘值 – 財產所得稅

期末需收回淨營運資金。（-$1,500,000 – $633,750 – … + $1,023,750 = - $1,890,000）
第 13 題  Calculating a Bid Price（第 7 章，#32，224 頁。）

Another utilization of cash flow analysis is setting the bid price on a project. To calculate the bid price, we set the project NPV equal to zero and find the required price. Thus the bid price represents a financial break-even level for the project. Guthrie Enterprises needs someone to supply it with 150,000 cartons of machine screws per year to support its manufacturing needs over the next five years, and you've decided to bid on the contract. It will cost you $780,000 to install the equipment necessary to start production; you'll depreciate this cost straight-line to zero over the project's life. You estimate that in five years this equipment can be salvaged for $50,000. Your fixed production costs will be $240,000 per year, and your variable production costs should be $8.50 per carton. You also need an initial investment in net working capital of $75,000. If your tax rate is 35 percent and you require a 16 percent return on your investment, what bid price should you submit?

【分析】
我們準備評估一筆供應每年 150,000 箱 (共 5 年) 螺絲訂單的投標案。
該訂單的損益平衡每箱單價, 是我們下標的重要參考數據。
投資年限 5 年, 設備期初投資$780,000, 期末殘值$50,000, 採直線折舊法, 全數折舊。
每年固定生產成本$240,000, 每箱變動成本$8.5。
期初需投入淨營運資金$75,000。
公司稅率 35%，可接受投資報酬率 16%。

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折現率：16%  NPV = $0

我們指定 NPV 爲目標值，目標值為 0，單價為變數儲存格，然後執行 Excel 之『目標搜尋』功能來求得以上答案。

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因為各年的營運現金流量皆相同，我們可以有更簡單的作法。假設每年損益平衡的營運現金流量為 OCF，則

\[
NPV = -期初資本投資 - 期初淨營運資金投資 + 每年營運現金流量 \\
+ 期末殘值回收 + 期末淨營運資金回收 \\
= -780,000 - 75,000 + OCF \times PVIFA_{16\%5} \\
+ 50,000 \times (1 - 35\%) \times PVIF_{16\%5} + 75,000 \times PVIF_{16\%5}
\]

\[
OCF = (\text{銷貨金額 - 銷貨成本}) \times (1 - 35\%) + \text{折舊稅盾} \\
= (price \times 150,000 - $240,000 - $8.5 \times 150,000) \times (1 - 35\%) + \frac{780,000}{5} \times 35\%
\]

由(1)，令 \(NPV = 0\)，可算得損益平衡營運現金流量:

\[
OCF = \frac{780,000 + 75,000 + (50,000 \times 65\% + 75,000) \times PFIF_{16\%5}}{PFIFA_{16\%5}} = $245,494
\]

將數值帶入(2)，可得損益平衡單位價格:

\[
price = \frac{245,494 - (780,000/5) \times 35\% + (240,000 + 8.5 \times 150,000) \times 65\%}{150,000 \times 65\%} = $12.06
\]
第14题  Financial Break-Even Analysis （第7章，#33，224页。）

The technique for calculating a bid price can be extended to many other types of problems. Answer the following questions using the same technique as setting a bid price; that is, set the project NPV to zero and solve for the variable in question.
a. In the previous problem, assume that the price per carton is $13 and find the project NPV. What does your answer tell you about your bid price? What do you know about the number of cartons you can sell and still break even? How about your level of costs?
b. Solve the previous problem again with the price still at $13-but find the quantity of cartons per year that you can supply and still break even. (Hint: It's less than 150,000.)
c. Repeat (b) with a price of $13 and a quantity of 150,000 cartons per year, and find the highest level of fixed costs you could afford and still break even. (Hint: It's more than $240,000.)

【分析】

延續上一題。令每箱單價、每年銷售數量、固定生產成本分別為 price 、Q 、F ，則我們面臨以下的方程式:

\[ NPV = -P_0 - NWC + S \times 65% \times PVIF_{16\%} + NWC \times PVIF_{16\%} + \left[ \left( price \times Q - F - S \times 8.5 \times Q \right) \times 65% + \frac{P_0}{S} \times 35\% \right] \times PVIFA_{16\%} \]

其中，P_0 為設備期初投資金額，NWC 為淨營運資金，S 為設備期末殘值。
(a) 令 price = $13 、 F = $240,000 、 Q = 150,000 ，求 NPV 。
(b) 令 price = $13 、 F = $240,000 、 NPV = 0 ，求 Q 。
(c) 令 price = $13 、 Q = 150,000 、 NPV = 0 ，求 F 。

<table>
<thead>
<tr>
<th>期初投資:</th>
<th>$780,000</th>
<th>固定成本:</th>
<th>$240,000</th>
<th>公司稅率: 35%</th>
</tr>
</thead>
<tbody>
<tr>
<td>殘值:</td>
<td>$50,000</td>
<td>變動成本:</td>
<td>$8.5</td>
<td>折現率: 16%</td>
</tr>
<tr>
<td>淨營運資金:</td>
<td>$75,000</td>
<td>單價:</td>
<td>$13.00</td>
<td>數量: 150,000</td>
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<tr>
<td>資本投資與淨營運資金現值:</td>
<td>-$803,817.85</td>
<td>OCF:</td>
<td>$245,494</td>
<td></td>
</tr>
</tbody>
</table>

NPV: $300,765
損益平衡價格: $12.06
損益平衡數量: 118,596
損益平衡固定成本: $381,318

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第 15 題  Replacement Decisions  （第 7 章，#35，224 頁。）

Suppose we are thinking about replacing an old computer with a new one. The old one cost us $650,000; the new one will cost $780,000. The new machine will be depreciated straight-line to zero over its five-year life. It will probably be worth about $140,000 after five years. The old computer is being depreciated at a rate of $130,000 per year. It will be completely written off in three years. If we don't replace it now, we will have to replace it in two years. We can sell it now for $230,000; in two years it will probably be worth $90,000. The new machine will save us $125,000 per year in operating costs. The tax rate is 38 percent, and the discount rate is 14 percent.

a. Suppose we recognize that if we don't replace the computer now, we will be replacing it in two years. Should we replace now or should we wait? (Hint: What we effectively have here is a decision either to “invest” in the old computer-by not selling it-or to invest in the new one. Notice that the two investments have unequal lives.)

b. Suppose we consider only whether we should replace the old computer now without worrying about what's going to happen in two years. What are the relevant cash flows? Should we replace it or not? (Hint: Consider the net change in the firm's after tax cash flows if we do the replacement.)

【分析】
設備更新問題最重要的考量點，是我們會持續需要這項設備。因此，相對於淨現值法，用約當年金（EAC）法來評估會比較恰當。這題，(a)要我們用約當年金法評估，而(b)則不特別強調設備更新，只需用淨現值法評估兩個互斥方案。

新電腦：費用$780,000，使用年限 5 年，直線折舊，殘值$140,000；每年成本 $125,000 。

舊電腦：目前殘值$230,000，還可提 3 年折舊（每年$130,000），2 年後殘值$90,000。

公司稅率 38%，折現率 14%。

\[
NPV_{\text{新電腦}} = -$780,000 + \left( \frac{$125,000 \times 62\% + $780,000}{5} \times 38\% \right) \times PVIFA_{14\%, 5}
+ $140,000 \times 62\% \times PVIF_{14\%, 5}
\]

\[
EAC_{\text{新電腦}} = \frac{NPV_{\text{新電腦}}}{PVIFA_{14\%, 5}}
\]

\[
NPV_{\text{舊電腦}} = -($230,000 \times 62\% + $390,000 \times 38\%) + $130,000 \times 38\% \times PVIFA_{14\%, 2}
+ ($90,000 \times 62\% + $130,000 \times 38\%) \times PVIF_{14\%, 2}
\]

\[
EAC_{\text{舊電腦}} = \frac{NPV_{\text{舊電腦}}}{PVIFA_{14\%, 2}}
\]

新電腦 費用：$780,000 年限：5 殘值：$140,000 節省：$125,000

舊電腦 殘值1：$230,000 年限：2 殘值2：$90,000 折舊：$130,000

公司稅率 38% 折現率：14%

新電腦 NPV = -$265,342 EAC = -$77,290

舊電腦 NPV = -$128,507 EAC = -$78,041