

## Question 1

### Assumptions:

1. Initial sales commence in month five.
2. Initial sales commenced at 5,000 downloads and priced at \$2.99 per download.
3. From months six through twelve, unit sales growth/monthly growth rate of 15% is expected.
4. Flat thereafter, stabilization is expected at sales volume.
5. The app will become obsolete after 18 months, revision or replacement necessity.

### Methodology:

1. Initial Revenue Calculation - Till Month 5

$$\begin{aligned}\text{Initial Revenue} &= \text{Initial Sales Volume} * \text{Price per Download} \\ &= 5,000 \text{ downloads} * \$2.99 \\ &= \$14,950\end{aligned}$$

2. Growth Phase - Months 6-12

New sales volume calculation is done with applying growth rate to the previous month sales volume and acquiring next month's sales volume

$$\text{New Sales Volume} = \text{Previous Month Sales Volume} * (1 + \text{Growth Rate})$$

$$\text{Monthly Revenue} = \text{New Sales Volume} * \text{Price per Download}$$

I solved and calculated these more systematically in my code but again,

$$\begin{aligned}\text{Monthly Revenue} &= \text{Previous Month Sales Volume} * (1 + \text{G.R.}) * \text{Price per Download} \\ &= \text{Previous Month Sales Volume} * (1 + 0.15) * \$2.99\end{aligned}$$

$$\text{Revenue Month six: } 5,000 * (1 + 0.15) * \$2.99 = 5,750 * \$2.99 = \$17,192.50$$

$$\text{Revenue Month seven: } 5,750 * (1 + 0.15) * \$2.99 = 6,613 * \$2.99 \approx \$19,770.87$$

$$\text{Revenue Month eight: } 6,613 * (1 + 0.15) * \$2.99 = 7,605 * \$2.99 \approx \$22,736.95$$

$$\text{Revenue Month nine: } 7,605 * (1 + 0.15) * \$2.99 = 8,746 * \$2.99 \approx \$26,149.54$$

$$\text{Revenue Month ten: } 8,746 * (1 + 0.15) * \$2.99 = 10,058 * \$2.99 \approx \$30,073.42$$

$$\text{Revenue Month eleven: } 10,058 * (1 + 0.15) * \$2.99 = 11,567 * \$2.99 \approx \$34,575.33$$

$$\text{Revenue Month twelve: } 11,567 * (1 + 0.15) * \$2.99 = 13,302 * \$2.99 \approx \$39,742.98$$

It can clearly seen that application sale volume increases due to gained market share, Thus revenue calculation grows rapidly.

3. Flat Phase - Month 12-18

Sales volume flat, remains same.

$$\text{Revenue from months thirteen to eighteen} = \text{Revenue of month 12}$$

$$6 \text{ months, thus, Revenue of month 12} * 6 = \$238\,457.88$$

4. Total Revenue - Month 1-18

Sum of all months:

$$\text{For 1-5} \rightarrow \$14,950$$

$$\text{For 6-12} \rightarrow \$190,241.59$$

$$\text{For 12-18} \rightarrow \$238\,457.88$$

$$\text{Total} \rightarrow \$443,649.47$$

5. Obsolescence

After the 18th month no revenue is expected.

I have calculated all those and taken an export form with Python code.

	A	B	C	
1	Month	Downloads	Revenue	
2	1	0	0	
3	2	0	0	
4	3	0	0	
5	4	0	0	
6	5	5000	14950	
7	6	5750	17192,5	
8	7	6612,5	19771,38	
9	8	7604,375	22737,08	
10	9	8745,031	26147,64	
11	10	10056,79	30069,79	
12	11	11565,3	34580,26	
13	12	13300,1	39767,3	
14	13	13300,1	39767,3	
15	14	13300,1	39767,3	
16	15	13300,1	39767,3	
17	16	13300,1	39767,3	
18	17	13300,1	39767,3	
19	18	13300,1	39767,3	
20				

## Question 2

Sensitivity analysis is conducted to evaluate the impact on month 18 revenue to determine the accuracy of their revenue estimates above.

### 1. Variations In Growth Rate

#### Impact of the variations in growth rate on month 18 revenue

##### Assumptions:

Variations in 2% increments between 9-21%  
in the growth rate of unit sales in Months 5-12  
(that is, 9%, 11%,..., 19%, 21%)

Monthly download count will be updated to new growth rates. For each growth rate scenario, monthly downloads are calculated with the compound formula for the months 6 to 12.

Monthly Revenue=Current Month Downloads×Price per Download

#### Growth Rate Sensitivity

Initial sales volume starts with the volume of 5,000 downloads in the 5th month.

We need to apply each growth rate (9%, 11%, 13%, 15%, 17%, 19%, 21%) from months 6 - 12 and for months 12-18, sales volume remains constant. We will assume no further growth. Finally, we should calculate revenue for the 18th month.

Month 6 Downloads = Month 5 Downloads \* (1 + Growth Rate)

Month 7 Downloads = Month 6 Downloads \* (1 + Growth Rate)

...

Month 12 Downloads = Month 11 Downloads \* (1 + Growth Rate)

### 2. Variation in Initial Sales Volume:

#### Assumptions:

Next we'll evaluate how variations in initial sales volume affect 18th month revenue.

Ranging from 2,500 to 7,500 in 500 unit increments. ( 2500,3000,3500...7500)

The revenue should be recalculated for each initial sales volume.

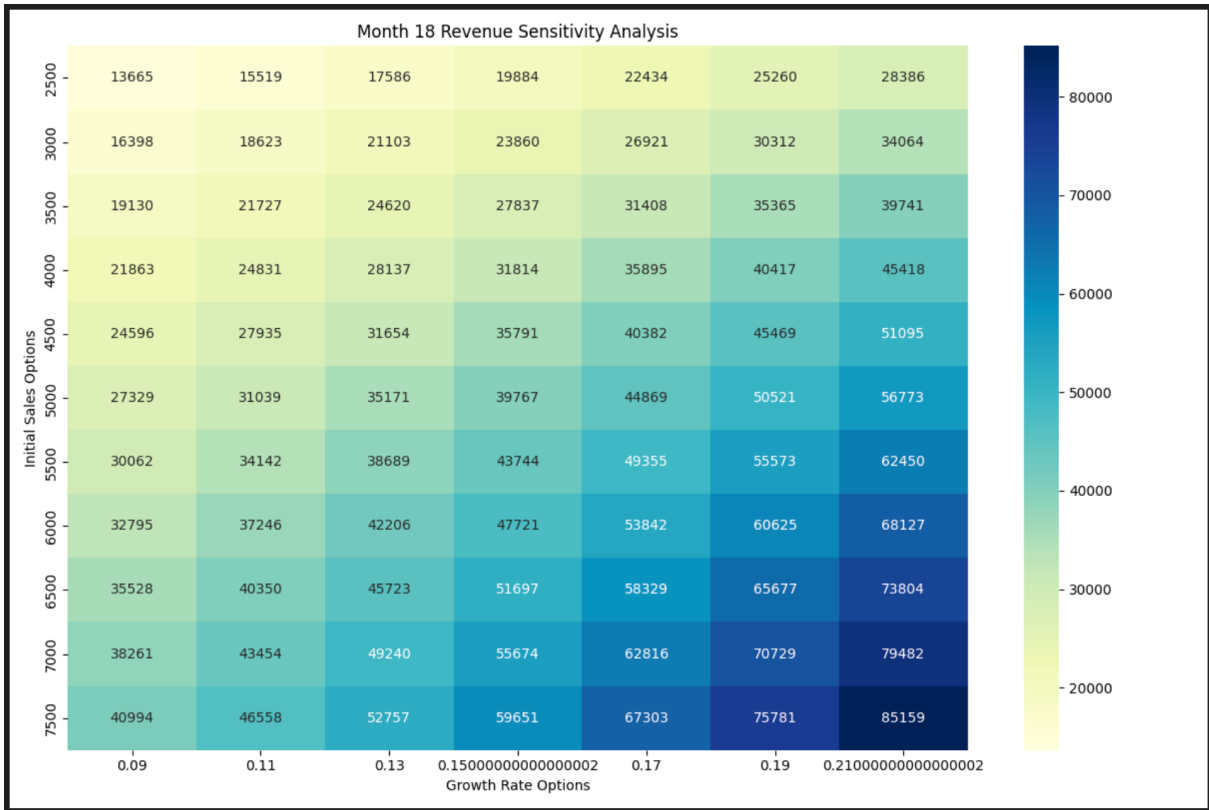
#### For Initial Sales Volume Sensitivity:

From 2,500 to 7,500 downloads, for each new initial sales volume value or say each new configuration of initial sales volume value, we'll keep growth rate constant as 15% from month 6-12. Then from 12th to 18th months, sales volume remains the same. Then, month 18th revenue will be calculated with each of different values of initial sales volume.

As again like this: Monthly Revenue=Current Month Downloads×Price per Download  
For each growth rate these calculations can be applied again as 15%.

This is valid for the both a and b section of question. One of the variables from one of them can be kept constant and other variables can be changed and vice versa. Finally results of all configurations will be visible.

These are analyzed and illustrated in the figures generated by the Python scripts below. You can see a detailed table and a heatmap, which shows the Month 18 revenue with various initial sales volume and growth rate scenarios. One figure is an export form of an Excel file produced by Python, and another is an export form of an HTML file produced by Python again and this time it shows the results of calculations more particular. .



	0.090000	0.110000	0.130000	0.150000	0.170000	0.190000	0.210000
2500	\$13,664.59	\$15,519.30	\$17,585.73	\$19,883.65	\$22,434.28	\$25,260.38	\$28,386.30
3000	\$16,397.51	\$18,623.16	\$21,102.87	\$23,860.38	\$26,921.14	\$30,312.46	\$34,063.56
3500	\$19,130.43	\$21,727.02	\$24,620.02	\$27,837.11	\$31,408.00	\$35,364.54	\$39,740.82
4000	\$21,863.35	\$24,830.88	\$28,137.16	\$31,813.84	\$35,894.86	\$40,416.61	\$45,418.08
4500	\$24,596.27	\$27,934.73	\$31,654.31	\$35,790.57	\$40,381.71	\$45,468.69	\$51,095.34
5000	\$27,329.18	\$31,038.59	\$35,171.45	\$39,767.30	\$44,868.57	\$50,520.77	\$56,772.60
5500	\$30,062.10	\$34,142.45	\$38,688.60	\$43,744.03	\$49,355.43	\$55,572.84	\$62,449.86
6000	\$32,795.02	\$37,246.31	\$42,205.74	\$47,720.76	\$53,842.28	\$60,624.92	\$68,127.12
6500	\$35,527.94	\$40,350.17	\$45,722.89	\$51,697.49	\$58,329.14	\$65,677.00	\$73,804.38
7000	\$38,260.86	\$43,454.03	\$49,240.03	\$55,674.22	\$62,816.00	\$70,729.07	\$79,481.64
7500	\$40,993.78	\$46,557.89	\$52,757.18	\$59,650.95	\$67,302.85	\$75,781.15	\$85,158.90

	A	B	C	D	E	F	G	H	
1		0,09	0,11	0,13	0,15	0,17	0,19	0,21	
2	2500	13664,59	15519,3	17585,73	19883,65	22434,28	25260,38	28386,3	
3	3000	16397,51	18623,16	21102,87	23860,38	26921,14	30312,46	34063,56	
4	3500	19130,43	21727,02	24620,02	27837,11	31408	35364,54	39740,82	
5	4000	21863,35	24830,88	28137,16	31813,84	35894,86	40416,61	45418,08	
6	4500	24596,27	27934,73	31654,31	35790,57	40381,71	45468,69	51095,34	
7	5000	27329,18	31038,59	35171,45	39767,3	44868,57	50520,77	56772,6	
8	5500	30062,1	34142,45	38688,6	43744,03	49355,43	55572,84	62449,86	
9	6000	32795,02	37246,31	42205,74	47720,76	53842,28	60624,92	68127,12	
10	6500	35527,94	40350,17	45722,89	51697,49	58329,14	65677	73804,38	
11	7000	38260,86	43454,03	49240,03	55674,22	62816	70729,07	79481,64	
12	7500	40993,78	46557,89	52757,18	59650,95	67302,85	75781,15	85158,9	
13									
14									

### Question 3

#### Initial Investments:

Investment of entrepreneur: \$300,000

Investment of family: \$150,000

Long-term debt (Borrowed) : \$200,000

Total initial investment amount: \$650,000

#### Projections of 1-5 Years Revenue's:

\$250,000 first year expected sales given, following years can be calculated with growth rates:

Year 2:  $\$250,000 \times 2 = \$500,000$

Year 3:  $\$500,000 \times 2 = \$1,000,000$

Year 4:  $\$1,000,000 \times 1.5 = \$1,500,000$

Year 5:  $\$1,500,000 \times 1.2 = \$1,800,000$

#### COGS, Expenses, and Tax Rate:

Cost of Goods Sold -> COGS -> 25% of sales.

Expense of Sellings -> 12% of sales.

Expense of General and Administrative Expense -> G&A -> \$100,000 + 7% of sales.

Corporate tax rate -> 35%

#### Management of Assets, Inventory, and Receivables/Payables:

accounts receivable equals 20 percent of ending sales

inventory is 15 percent of cost of goods sold

accounts payable is 8 percent of cost of goods sold

wages payable is 5 percent of cost of goods sold

taxes payable is negligible.

### Cash Balance Requirements and Additional Financing Needs:

maintain a cash balance equal to the lesser of 20 percent of annual sales or \$50,000

if additional financing needed use long-term debt to the extent

Annual sales for each year with provided growth rates:

COGS, Selling Expense, and G&A Expense calculated for each year

```
# Income Statement calculations
pro_forma['COGS'] = pro_forma['Sales Forecast'] * 0.25
pro_forma['Selling Expenses'] = pro_forma['Sales Forecast'] * 0.12
pro_forma['G&A Expenses'] = 100000 + (pro_forma['Sales Forecast'] * 0.07)
```

from code solution.

Depreciation calculated with straight-line depreciation (over 5 years -> total investment / 5)

```
pro_forma['Depreciation'] = straight_line_depreciation

straight_line_depreciation = (
    initial_investment + family_investment + borrowed_amount) / 5

initial_investment = 300000 # Entrepreneur's investment
borrowed_amount = 200000 # Long-term debt
```

from code.

Income Statement is constructed for each year.

```
# Income Statement calculations
pro_forma['COGS'] = pro_forma['Sales Forecast'] * 0.25
pro_forma['Selling Expenses'] = pro_forma['Sales Forecast'] * 0.12
pro_forma['G&A Expenses'] = 100000 + (pro_forma['Sales Forecast'] * 0.07)
pro_forma['Depreciation'] = straight_line_depreciation
pro_forma['Total Operating Expenses'] = pro_forma['COGS'] + \
    pro_forma['Selling Expenses'] + \
    pro_forma['G&A Expenses'] + pro_forma['Depreciation']
pro_forma['EBIT'] = pro_forma['Sales Forecast'] - \
    pro_forma['Total Operating Expenses']
pro_forma['Interest Expense'] = borrowed_amount * interest_rate
pro_forma['Pre-Tax Income'] = pro_forma['EBIT'] - pro_forma['Interest Expense']
pro_forma['Tax'] = pro_forma['Pre-Tax Income'].apply(
    lambda x: max(0, x) * tax_rate)
pro_forma['Net Income'] = pro_forma['Pre-Tax Income'] - pro_forma['Tax']
```

Balance Sheet is constructed for each year:

Assets: Current assets included (Cash, Accounts Receivable, Inventory) and Long-term assets (Fixed Assets).

Liabilities:

Current liabilities included (Accounts Payable, Wages Payable) and

Long-term liabilities (Long-Term Debt).

Equity: Calculated as with adjustments to initial investments with annual net income-dividends

```
# Balance Sheet calculations
pro_forma['Accounts Receivable'] = pro_forma['Sales Forecast'] * 0.2
pro_forma['Inventory'] = pro_forma['COGS'] * 0.15
pro_forma['Accounts Payable'] = pro_forma['COGS'] * 0.08
pro_forma['Wages Payable'] = pro_forma['COGS'] * 0.05
pro_forma['Cash'] = pro_forma['Sales Forecast'].apply(
    lambda x: min(x * 0.20, 50000))
pro_forma['Total Current Assets'] = pro_forma['Cash'] + \
    pro_forma['Accounts Receivable'] + pro_forma['Inventory']
pro_forma['Fixed Assets'] = total_investment - \
    (pro_forma.index * straight_line_depreciation)
pro_forma['Total Assets'] = pro_forma['Total Current Assets'] + \
    pro_forma['Fixed Assets']

# Calculate additional capital investments needed to maintain net fixed assets at 1.2 times the expected sales for the subsequent year
pro_forma['Additional Capital Investments'] = pro_forma['Sales Forecast'].shift(
    -1) * 1.2 - pro_forma['Fixed Assets']
pro_forma['Additional Capital Investments'] = pro_forma['Additional Capital Investments'].clip(
    lower=0)
pro_forma['Fixed Assets'] += pro_forma['Additional Capital Investments']

# Long-term debt calculations
pro_forma['Long-Term Debt'] = borrowed_amount - \
    (pro_forma.index * straight_line_depreciation) + \
    pro_forma['Additional Capital Investments']
pro_forma['Total Liabilities'] = pro_forma['Long-Term Debt'] + \
    pro_forma['Accounts Payable'] + pro_forma['Wages Payable']
pro_forma['Equity'] = total_equity + pro_forma['Net Income'].cumsum()
pro_forma['Total Liabilities & Equity'] = pro_forma['Total Liabilities'] + \
    pro_forma['Equity']
```

Cash flow Statement Calculations:

```
# Cash Flow Statement calculations
pro_forma['Change in Accounts Receivable'] = pro_forma['Accounts Receivable'].diff().fillna(0)
pro_forma['Change in Inventory'] = pro_forma['Inventory'].diff().fillna(0)
pro_forma['Change in Accounts Payable'] = pro_forma['Accounts Payable'].diff().fillna(0)
pro_forma['Change in Wages Payable'] = pro_forma['Wages Payable'].diff().fillna(0)
pro_forma['Change in Cash'] = pro_forma['Cash'].diff().fillna(0)
pro_forma['Operating Cash Flow'] = pro_forma['Net Income'] + pro_forma['Depreciation'] - pro_forma['Change in Accounts Receivable'] - \
    pro_forma['Change in Inventory'] + pro_forma['Change in Accounts Payable'] + \
    pro_forma['Change in Wages Payable']
pro_forma['Capital Expenditures'] = pro_forma['Additional Capital Investments']
pro_forma['Financing Cash Flow'] = borrowed_amount - \
    pro_forma['Long-Term Debt'].diff().fillna(0) + \
    pro_forma['Equity'].diff().fillna(0)
pro_forma['Beginning Cash'] = 0 # You can set the initial cash balance here
pro_forma['Ending Cash'] = pro_forma['Beginning Cash'] + pro_forma['Operating Cash Flow'] - \
    pro_forma['Capital Expenditures'] + \
    pro_forma['Financing Cash Flow'] + pro_forma['Change in Cash']
```



	A	B	C	D	E	F	G	H	
1		0	1	2	3	4	5	6	
2	Period	Beginning	Period 1	Period 2	Period 3	Period 4	Period 5	ETC	
3	Sales Forecast	0	250000	500000	1000000	1500000	1800000	2592000	
4	Income Statement								
5	COGS	0	62500	125000	250000	375000	450000	648000	
6	Selling Expenses	0	30000	60000	120000	180000	216000	311040	
7	G&A Expenses	100000	117500	135000	170000	205000	226000	281440	
8	Depreciation	130000	130000	130000	130000	130000	130000	130000	
9	Total Operating Expenses	230000	340000	450000	670000	890000	1022000	1370480	
10	EBIT	-230000	-90000	50000	330000	610000	778000	1221520	
11	Interest Expense	18000	18000	18000	18000	18000	18000	18000	
12	Pre-Tax Income	-248000	-108000	32000	312000	592000	760000	1203520	
13	Tax	0	0	11200	109200	207200	266000	421232	
14	Net Income	-248000	-108000	20800	202800	384800	494000	782288	
15	Balance Sheet								
16	Accounts Receivable	0	50000	100000	200000	300000	360000	518400	
17	Inventory	0	9375	18750	37500	56250	67500	97200	
18	Accounts Payable	0	5000	10000	20000	30000	36000	51840	
19	Wages Payable	0	3125	6250	12500	18750	22500	32400	
20	Cash	0	50000	50000	50000	50000	50000	50000	
21	Total Current Assets	0	109375	168750	287500	406250	477500	665600	
22	Fixed Assets	650000	600000	1200000	1800000	2160000	3110400		
23	Total Assets	650000	629375	558750	547500	536250	477500	535600	
24	Additional Capital Investments	0	80000	810000	1540000	2030000	3110400		
25	Long-Term Debt	200000	150000	750000	1350000	1710000	2660400		
26	Total Liabilities	200000	158125	766250	1382500	1758750	2718900		
27	Equity	202000	94000	114800	317600	702400	1196400	1978688	
28	Total Liabilities & Equity	402000	252125	881050	1700100	2461150	3915300		
29	Cash Flow Statement								
30	Change in Accounts Receivable	0	50000	50000	100000	100000	60000	158400	
31	Change in Inventory	0	9375	9375	18750	18750	11250	29700	
32	Change in Accounts Payable	0	5000	5000	10000	10000	6000	15840	
33	Change in Wages Payable	0	3125	3125	6250	6250	3750	9900	
34	Change in Cash	0	50000	0	0	0	0	0	
35	Operating Cash Flow	-118000	-29250	99550	230300	412300	562500	749928	
36	Capital Expenditures	0	80000	810000	1540000	2030000	3110400		
37	Financing Cash Flow	200000	142000	-379200	-197200	224800	-256400	982288	
38	Beginning Cash	0	0	0	0	0	0	0	
39	Ending Cash	82000	82750	-1089650	-1506900	-1392900	-2804300		
40									
41									



## Question 4

Those are assumptions of question4:

```
# Constants and Initial Conditions
year_3_sales_target = 5e6 # $5 million sales target in Year 3
operating_margin = 0.20 # EBIT/Sales
tax_rate = 0.30 # Tax rate
asset_turnover = 5 # Asset turnover ratio
initial_equity_funding = 200000 # Initial equity funding by founders
interest_rate_debt = 0.08 # Interest rate for debt
```

Calculations of a:

```
# Calculations
# a. Determine if initial equity is sufficient for Year 3 sales target
# Using the formula: Sales = Total Assets / Asset Turnover
# and EBIT = Operating Margin * Sales
# and Net Income = EBIT * (1 - Tax Rate)
# We reverse calculate from the desired Net Income to required Sales and Total Assets

# Required EBIT to meet sales target
required_ebit = year_3_sales_target * operating_margin

# Required Net Income to achieve the EBIT target
required_net_income = required_ebit * (1 - tax_rate)

# Required Total Assets to achieve the sales target
required_total_assets = year_3_sales_target / asset_turnover

# Check if initial equity is sufficient
sufficient_equity = initial_equity_funding >= required_total_assets
```

In the code, formulas are given.

Calculations of b:

```
# b. Calculate required debt if initial equity is not sufficient
required_debt = 0
if not sufficient_equity:
    # Additional funds needed
    additional_funds_needed = required_total_assets - initial_equity_funding

    # Total debt needed considering the interest expense that can be covered by EBIT
    # EBIT should be sufficient to cover interest expense: EBIT = Interest Expense / Interest Rate
    # Rearranging the formula: Debt = EBIT / Interest Rate
    required_debt = required_ebit / interest_rate_debt
```

In the code, formulas are given.

Results:

Needed initial investment is calculated based on whether or not there is enough initial equity funding. If not, initial investment is set to the total assets required to achieve 3rd year sales goals.

If there is sufficient equity, initial investment needed is set to initial equity funding.

So,

Part (a) calculates -> required initial equity funding to achieve 3rd year sales goals.

Part (b) calculates -> required debt according to status (sufficient/not) of initial equity

```
Sufficient initial equity funding: False  
Initial equity funding needed: $1000000.0  
Required debt if using debt financing: $12500000.0
```

Those are results from the calculations.

This is the project online to see my authorship and all calculations of work:

<https://github.com/kubraaksux/AD420-Financial-Modeling>

Kübra Aksu