

Carnegie Mellon University in Qatar  
15390 - Spring 2018

Problem Set 3

**Out: March 11, 2018**

**Due: March 22, 2018**

### Problem I [15 Points]

- A. Is it possible to compound \$300 to become \$600 over 7 years, assuming an interest rate of 10%? Explain all your reasoning and show all your calculations.
- B. Compute  $\lim_{n \rightarrow \infty} P(1 + \frac{r}{n})^{tn}$ , assuming  $P$  is the principal amount of money,  $r$  is the interest rate,  $t$  is the number of years, and  $n$  is the number of times  $P$  is compounded every year.

### Problem II [15 Points]

Erin recently graduated from CMU-Q with a BS in Computer Science. In August 2015, he borrowed \$50,000 and borrowed another \$50,000 in August 2016. His student loan has an annual interest rate of 2% compounded monthly. Erin does not make any payments on his debt until he starts a lucrative Google job. Then starting in September 2017, he makes a payment of \$1000 every month. Now bonus time is coming soon. For January 2018, he plans to make another \$1000 payment and also apply his bonus to the debt. How big must his bonus be so that he will have completely paid-off the debt at the end of this January? Show and explain all your calculations.

### Problem III [20 Points]

Assuming a discount rate of 9%, which of the following options do you prefer most? Show and explain all your calculations.

- A:** Receive \$80 today and \$80 in 5 years.
- B:** Pay \$60 every year for 4 years, starting from next year, and subsequently (meaning after 4 years) receive \$40 every year for 25 years.
- C:** Receive \$10 every year, forever, starting today.
- D:** Receive \$20 every other year, forever, starting today.

*Problem Set continues on the next page*

## Problem IV [50 Points + 10 Bonus]

Med4You is a new tech company located in Doha. It offers an app that allows patients to input their chief complaints and, accordingly, schedule appointments with suitable doctors in Qatar. More precisely, the app leverages the input complaints of a patient and recommends a doctor with a particular specialty, who is most suitable to handle this patient's case.

Med4You partners with health care facilities in Qatar to have their doctors recommended by its app. In particular, a clinic or a hospital can participate on Med4You's app via paying a fee of 2.5% from the revenue generated by every medical session resulting from an appointment scheduled over Med4You's app. Aside from the 2.5% commission fee, Med4You does not charge any other fee on integrating its system with any facility's system, let alone maintaining and updating such integration over time.

Med4You plans to cover only Qatar in the coming five years (now, 2018!). To this end, it hired only a single salesperson to try to convince hospitals and clinics in Qatar to participate on its app. The starting full package of this salesperson is \$110,000, but it increases 3% every year, for five consecutive years. In addition, Med4You hired a lawyer for two years, with a full package of \$90,000 per year. The lawyer is well-versed in the regulations of medicine in Qatar and can work with the responsible government officials to obtain any required permission and ensure that all Med4You's activities are in concordance with Qatar's health regulations. Lastly, Med4You hired a web developer who will design its website and develop all the ad material needed for a strong online presence. The web developer, the ad material, and the total price of distributing ads on various online platforms will cost Med4You \$100,000 per year for the coming five years.

Assume the following:

- The expected total number of appointments made through Med4You is 200,000 in year 2018 and it is expected to increase by 4%, 10%, 25%, and 45% in years 2019, 2020, 2021, and 2022, respectively.
- The average revenue made by health care facilities in Qatar from every medical session is \$35.
- The gross margin of Med4You is 85%.
- The retention rates on Med4You's app are potentially 65%, 70%, 75%, 80%, and 90% in years 2018, 2019, 2020, 2021, and 2022, respectively.
- Cost of capital rate is 45%.

All other costs can be ignored.

*Questions start on the next page*

- A. Explain the advantages and disadvantages of **Med4You**'s business model from the perspectives of the economic seller, economic buyer, and end-users. **(5 Points)**
  
- B. What is the LTV of **Med4You** over the given period of five years? Show and explain all supporting calculations. **(20 Points)**
  
- C. What is the COCA of **Med4You** over the given period of five years? Show and explain all supporting calculations. **(14 Points)**
  
- D. Do you expect **Med4You** to be profitable in the given period of five years? Explain your reasoning. **(4 Points)**
  
- E. Suggest and discuss ways for **Med4You** to become a sustainable and attractive business in the coming few years. **(7 Points)**
  
- F. **Bonus:** Write a python program that allows you to compute LTV and COCA for **Med4You** automatically. *Note:* all required input should be made as parameters, wherein their values are passed through a file. **(10 Points)**