Solutions to Homework 3

Question 1.
(25 points): Venture Capital

(a) The three types of VCs are:

i. **Angel Investors**. These are individuals that typically make small investments in a very early-stage start-up company. One typical motivation for an angel is a dramatic return on their initial investment via exit or a liquidity event (*e.g.*, the IPO or subsequent financing rounds). Another is personal interest in the industry and the technology.

ii. **Financial VCs**. These are investment firms with capital raised from institutions and individuals. They are often organized as formal VC funds, but they are sometimes organized as holding companies. Their motivation is purely financial, *i.e.*, to maximize the returns on their investments.

iii. **Strategic VCs**. These are typically small divisions of large technology companies. They provide corporate funding for strategic investments, helping companies whose success may spur growth of the larger corporation of which the strategic VC is a division. They may provide investees with valuable connections and partnerships.

(b) Financial VCs.

(c) As Dr. Kearns explained in his lecture on October 18, entrepreneurs have no choice but to go to VCs. Banks will not talk to them. Banks’ business model and expectations are completely different from those of VCs, and banks are very risk-averse. In particular, a bank will not lend $5 million to a company unless the company has (at least roughly) $5 million worth of collateral, which is something that a start-up won’t have.

(d) In general, this simple case of anti-dilution protection works as follows: Let $N_1$ be the number of shares owned by the founder after the first round, $N_2$ be the total number owned by the first-round VC after the first round, and $N_3$ be the number of shares issued by the founder in the subsequent “down round.” Let $p_1$ be the first-round price per share and $p_2$ be the down-round price per share. Then the new number of shares owned by the (anti-dilution-protected) first-round VC will be

$$N_2 \times \frac{p_1}{q},$$

and the new total number of shares will be

$$\left( N_2 \times \frac{p_1}{q} \right) + N_1 + N_3.$$

The difference between weighted ratchet and full ratchet is in how $q$ is computed.
**Weighted Ratchet:** Here, \( q \) is the weighted average of the founder’s first-round price per share and the founder’s down-round price per share:

\[
\frac{N_1 p_1 + N_3 p_2}{N_1 + N_3}.
\]

**Full Ratchet:** Here, \( q \) is simply the down-round price per share, i.e., \( p_2 \).

In this homework question, we have \( N_1 = N_2 = 100, p_1 = 1, N_3 = 10 \), and \( p_2 = 0.2 \). So the answers are:

<table>
<thead>
<tr>
<th>Number of shares:</th>
<th>First-round VC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted ratchet</td>
<td>107.84</td>
<td>217.84</td>
</tr>
<tr>
<td>Full ratchet</td>
<td>500</td>
<td>610</td>
</tr>
</tbody>
</table>

**Question 2.**
(15 points): B2B marketplaces

(a) Vertical B2Bs are systems of suppliers, distributors, and customers within a single industry that communicate using the Internet to perform exchanges to buy and sell goods and services. Their product focus is on the supply chain of one product category or on expertise and in-depth content knowledge for one industry. Horizontal B2Bs are systems across many industries with broad product focus. Like vertical B2Bs, they also provide infrastructure for transactions over the Internet and allow integration between businesses. Examples of Vertical B2Bs include Covisint and MetalSite (see slide 10 of the October 23 lecture notes). Examples of Horizontal B2Bs include HotOffTheWire and equalFooting (see slide 9 of the October 23 lecture notes).

(b) v (all of the above).

**Question 3.**
(20 points): C2C Internet Services

(a) eBay provides a website to auction goods. Sellers pay a small fee per item they want to sell, and eBay takes a cut of the final sale price. These fees are small in comparison to the exposure the sellers get from conducting their auctions via the Internet. eBay does not handle payments or shipping between the buyer and seller; its only costs are website operation. Because so many items are listed every day, eBay can make a profit from the small fees it charges.

(b) Correct answers include the following. Only two are needed for full credit.

- Fixed-price online retailing, *e.g.*, through acquisition of Half.com.
- Sale of “distressed inventory” of tech companies, *e.g.*, IBM, which has its own store at www.ebaystores.com/ibm.
- Sale of art and luxury goods through “eBay Premier.”
- “Buy it now,” which gives the buyer a chance to buy immediately at a known price, without having to participate in an auction.
The two main reasons given in class were:
- eBay is a real (profitable) business with real revenue models. Napster, on the other hand, was a popular free service with no revenue stream and no (known) real business model.
- What eBay does is basically legal, and what Napster was doing was basically illegal.

Only one of these reasons is needed for full credit.

**Question 4.**
(20 points): Privacy
(a) False. (As explained in “P3P and Privacy: An Update for the Privacy Community,” P3P cannot ensure that companies actually follow their posted privacy policies.)
(b) Law, Norms, Markets, Architecture.
(c) False. (As he explains on page 17 of “The Architecture of Privacy,” these property rights will have costs, e.g., the costs inherent in negotiation. Having to “dicker” over each mouse click would not be feasible. He suggests “architecture” as a way to enable lower-cost negotiation.)

**Question 5.**
(25 points): XML and Document Types
(a) The underlined phrases are all possible XML document types.

A customer calls a contact-lens manufacturer and says, “I looked in your catalog and found a contact lens I want to order. If I send you a purchase order and a prescription, when will I receive an invoice with the order confirmation and expected shipping date?”

(b) Here are sample DTDs for the five document types above:

**Catalog:**

```xml
<!DOCTYPE CATALOG [
  <!ELEMENT item (name, price, amount_in_stock?, comments?)>
  <!ELEMENT name (#PCDATA)+>
  <!ELEMENT price (#PCDATA)+>
  <!ELEMENT comments (#PCDATA)+>
  <!ELEMENT amount_in_stock (#PCDATA)+>
  <!ATTLIST item id CDATA #REQUIRED>
  <!ATTLIST price currency CDATA #IMPLIED>]
```

**Purchase Order:**

```xml
<!DOCTYPE ORDER [
  <!ELEMENT date (#PCDATA)+>
  <!ELEMENT item (id, quantity)>]
```
Contact Lens:
<!DOCTYPE LENS [<!ELEMENT lens (brand, price, minpower, maxpower)>]
<!ELEMENT brand (#PCDATA)>]
<!ELEMENT price (#PCDATA)>]
<!ELEMENT minpower (#PCDATA)>]
<!ELEMENT maxpower (#PCDATA)>]
<!ATTLIST lens
type (hard | soft) #REQUIRED
  toric (yes | no) 'no'
color CDATA #IMPLIED>
<!ATTLIST price currency CDATA #REQUIRED>
]>

Prescription:
<!DOCTYPE LENS_RX [<!ELEMENT Rx (left_eye, right_eye, doctor, comments?)>]
<!ELEMENT left_eye (brand, power, base_curve, toric_info?)>]
<!ELEMENT right_eye (brand, power, base_curve, toric_info?)>]
<!ELEMENT brand (#PCDATA)>]
<!ELEMENT power (#PCDATA)>]
<!ELEMENT base_curve (#PCDATA)>]
<!ELEMENT toric_info (#PCDATA)>]
<!ELEMENT comments (#PCDATA)>]
<!ELEMENT doctor (name, address, phone, license_no)>
<!ELEMENT name (#PCDATA)>]
<!ELEMENT address (#PCDATA)>]
<!ELEMENT phone (#PCDATA)>]
<!ELEMENT license_no (#PCDATA)>]
<!ATTLIST licence_no state CDATA #REQUIRED>
]>

Invoice:
<!DOCTYPE INVOICE [<!ELEMENT order_date (#PCDATA)>]
<!ELEMENT shipping_info (date, carrier)>]
<!ELEMENT date (#PCDATA)>]
<!ELEMENT carrier (#PCDATA)>]
<!ELEMENT item (id, name, price, quantity, comments?)>]
<!ELEMENT id (#PCDATA)>]
<!ELEMENT name (#PCDATA)>]
<!ELEMENT price (#PCDATA)>]
<!ELEMENT comments (#PCDATA)>]
<!ELEMENT quantity (#PCDATA)>]
<!ATTLIST price currency CDATA #REQUIRED>
<!ATTLIST quantity unit CDATA #IMPLIED>
]>
(c) Here are sample XML documents using the DTDs above:

Catalog:
<item id='CL1'>
    <name>Acuvue</name>
    <price>70</price>
    <amount_in_stock>300</amount_in_stock>
</item>

<item id='CL34'>
    <name>Focus Dailies</name>
    <price currency='dollars'>100</price>
    <comments>Available in many colors.</comments>
</item>

Purchase Order:
<date>11/1/2001</date>

<item id='CL34'><quantity>2</quantity></item>
<item id='CL1'><quantity>5</quantity></item>
<item id='CL15'><quantity>1</quantity></item>

Contact Lens:
<lens type='soft'>
    <brand>Acuvue</brand>
    <price currency='dollars'>70</price>
    <minpower>-0.25</minpower>
    <maxpower>-8.0</maxpower>
</lens>

Prescription:
<Rx>
    <left_eye>
        <brand>Acuvue</brand>
        <power>-6.00</power>
        <base_curve>14</base_curve>
    </left_eye>
    <right_eye>
        <brand>Acuvue</brand>
        <power>-5.50</power>
        <base_curve>14</base_curve>
    </right_eye>

    <comments>Please use standard diameter.</comments>

    <doctor>
        <name>Dr. Eye Pain</name>
        <address>15 Shadowbrook Lane
                   Burlington, VT</address>
        <phone>202-555-4543</phone>
        <license_no state='Vermont'>670023123</license_no>
    </doctor>
</Rx>
Invoice:
<order_date>11/1/2001</order_date>
<shipping_info>
  <date>11/7/2001</date>
  <carrier>UPS Ground</carrier>
</shipping_info>

=item>
  <id>CL1</id>
  <name>Acuvue</name>
  <price currency="dollars">70</price>
  <quantity unit="6-lens box">4</quantity>
</item>