1. (8 points) Of the following statements, identify all that hold about this e-business
   A. To build a modern XML-based system as advocated in this course, the main set of APIs we need is for an XML processing tool such as XQuery or XSLT
   B. Three main abstractions underlying modern information systems are tuples, trees, and templates
   C. Within an enterprise, different divisions may reasonably be treated as autonomous entities
   D. Going across enterprises, standardization can permanently remove heterogeneity

   Solution: A, C

   A: this course consistently advocates high-level abstractions for XML

   C: it always helps to model nonautonomous entities as autonomous to simply interoperation and maintenance

   D is false because heterogeneity is the steady state, so permanent removal of it doesn't make sense

2. (20 points) Of the following statements, identify all that hold about XSLT
   A. XSLT applies templates recursively by default, but only going downward in the XML document tree
   B. In XSLT, templates can be applied to parent, children, or other descendants of a node, but not to its grandparent
   C. XSLT allows only a proper subset of the XPath language to be used
   D. In XSLT, the copy-of element expresses a command that provides a deep copy of an element on which it is applied
   E. In XSLT, by default the attributes are ignored during recursive calls to apply templates
   F. In XSLT, templates can be applied on attributes if you specify them appropriately
   G. The empty XSLT transformation yields a (practically identical ignoring variations allowed by the XML Infoset) copy of a document on which it is applied
   H. It is possible to construct a nonempty XML document that yields a copy (practically identical ignoring variations allowed by the XML Infoset) when transformed by the empty XSLT transformation
   I. In XSLT, as in XPath, an attribute is not a child of its parent
   J. In XSLT, as in XPath, a text node is not a child of its parent

   Solution: A, D, E, F, I

3. (32 points) Of the following statements, identify all that hold about XML keys, integrity constraints, and other aspects of relating XML to databases:
   A. Referential integrity as captured by keyref means that an element that is referred to must exist
   B. When XML structures are mapped to relational schemas, XML key constraints are lost
   C. General XQuery expressions can be used to specify integrity constraints on XML documents
   D. A key allows more than one selector subelement in order to construct a composite key
   E. Contrary to its name, the data-centric view has little to do with relational database management
   F. The document-centric view gains prominence in business settings where audit trails are required
   G. Native XML databases support the storage of XML documents primarily by shredding
   H. XML has yet to become popular for messaging because messaging middleware does not support complex structures

I. It is possible to write a key selector referring to a grandchild element of the given element

J. If the document schema states that a specific grandchild element of the given element may contain only text, it is possible to write a field expression referring to the text occurring within that grandchild element

K. It is possible to write a field expression referring to the first grandchild element of the given element

L. ../child is allowed in a selector provided child is a particular element that exists in the appropriate context

M. Any mapping of XML to relational schemas requires selecting one or more tuple-generating elements

N. In mapping XML to tables, sometimes you would create a table with exactly one column

O. In mapping XML to tables, sometimes you would be forced to introduce additional columns

P. The general representation of an XML document in a relational schema can lead to multiple self-joins even for simple queries on the XML document

Solution: A, C, F, I, J, N, O, P

B is false because key constraints can be expressed in relational DBMSs

E is false because the regular structures of the data-centric view are motivated by relational structures. Further they map more easily to relational schemas than documents the exemplify the document-centric view

G is false because shredding an XML document is what you need for mapping it to a relational DBMS

J is true because the text is extracted by simply specifying the element that contains the text

K is false because the subset of XPath allowed in this setting doesn't include the [ ] selector construct

L is false because the subset of XPath allowed in this setting doesn't include the .. construct; it doesn't matter is child is an element that exists in the given context

M is false because you can have general representations such as for graphs that don't use a TGE from the document

N is true because sometimes your XML document's TGE may only have one attribute or no attributes and some text

O is true because you may need additional columns, e.g., to make sure each relational tuple is unique. For example, consider an XML document whose TGE has three copies for some attribute values and seven copies for another attribute value. In the relational representation you can't have duplicates (even if you step outside the pure model and allow duplicates, you can't control how many duplicates would be stored)

P is true because multiple self-joins is how you would extract structure information from a general representation: for example, to solve a query for the descendants of an element

4. (40 points) Of the following statements, identify all that are true about concepts of rationality, prices, and markets:

A. Prices are understood as scalars for convenience, but they could equally effectively be understood as vectors

B. Prices work in markets under the assumption that all agents value the same amount of money equally

C. One of the key assumptions for ensuring individual rationality via market mechanisms is that buyers prefer paying lower prices to higher prices and sellers prefer obtaining higher prices to lower prices

D. From the standpoint of ensuring optimality, buyers and sellers must be treated symmetrically

E. An auction ensures that if there are no buyers willing to pay the current price, the price will come down sooner or later

F. Utility functions make sense when money is considered and do not make much sense otherwise

G. If two agents each have the same preference relation as the other (over the same finite set of goods), then the two agents would have the same utility function

H. Utility theory assumes that agents seek to maximize their expected valuations (in the sense of probability-based lotteries)

I. If you are indifferent between A and B and indifferent between B and C, then you must be indifferent between A and C

J. If a risk seeking agent prefers a lottery L_1 to a lottery L_2, then a risk neutral agent would also prefer L_1 to L_2

K. If we require bids to be in whole dollar amounts, then an auction whose price is the second highest price plus \$0.50 would be as efficient as the Vickrey auction

L. Auction mechanisms handle trades between two parties at a time

M. The M^{th} highest price is the N^{th} lowest price

N. The McAfee auction is a uniform price mechanism

O. An online multiuser gaming site where players can trade points for virtual goods is an example of an endogenous market

P. Even though an agent participates in an incentive compatible mechanism, it may not reveal its true valuations

Q. The third-price auction for a single item would be incentive compatible for buyers

R. The third-price auction for two items would guarantee efficiency and be incentive compatible for buyers

S. The first-price auction for two or more items would not be incentive compatible for buyers

T. The first-price auction for two or more items would not be efficient

Solution: C, D, I, L, N, O, P, Q, R, S, T

A is false because vectors in general are not totally ordered, but prices must be comparable

B is false: prices are used commonly in the real world and nobody assumes that the entire human population places an equal value for money

C is true: better to pay less and receive more

D is true: the only difference between buyers and sellers is who happens to own the goods before the trade occurs, but optimality depends upon their valuations not on ownership

E is false because an auction makes no guarantees about future auctions

F is false because utility is a general concept, which even underlies understanding money

G is false because the same preference relation may be mapped to different utility functions. For example, we might both prefer ice cream to coffee, but that doesn't mean our utilities for ice cream and coffee are identical

H is false because risk (and not just expected value) is a crucial component of how agents assign utility

I is true because indifference means the agent can substitute between any two alternatives that he is indifferent between. Thus, the agent could substitute A for B and B for C, meaning that he can substitute A for C. Likewise, C for A. Thus the agent could not be said to prefer A to C or C to A: that is, he would be indifferent between A and C as well

J is false because a risk seeking agent may well have a higher utility for L_1 than for L_2 because L_1 has greater maximum payoff: their expected values may be unequal, which is what a risk neutral agent would consider

K is false because a deal can take place in the Vickrey auction only if the sell bid is not (strictly) greater than the highest buy bid: in the modified auction, a deal would fail even if the sell and the highest buy bid were equal

L is true because auctions match individual buyers and sellers: they don't create teams of buyers and sellers. Even combinatorial auctions match bundles of goods, but each party bids and is selected individually

M is false because it is off by one. For example, consider two distinct bids with M=N=1. The highest price is not the lowest price

P is true because what an agent reveals is its choice: the agent doesn't have to be rational

Q is true because the winning buyer's price would not depend on his bid

R is true because this an equilibrium price (hence efficient) and is not based on the winning bids (hence incentive compatible). Note that M=2, and so the third price is the $(M+1)^{st}$ price

S is true because a winning buyer may be the one who places the highest bid

T is true because the first price is possibly higher than the equilibrium price range. Specifically, the second highest buyer may be excluded. For example, if there are buy bids of \$9 and \$8 and sell bids of \$6 and \$5, at the first price of \$9, only the first buyer will trade although the second buyer would have accepted a price such as \$7, which both sellers would have accepted as well