1. (10 points) Of the following statements, identify all that hold about this e-business

   A. Messaging based on XML helps us engineer software systems that better address the challenges of heterogeneity than traditional, proprietary approaches

   > **Solution:** A is true: XML messaging facilitates addressing heterogeneity

   B. Market mechanisms for contracting tasks provide a basis for developing software systems that address the challenges of autonomy because market mechanisms support each prospective business partner independently deciding how much to bid for a particular contract

   > **Solution:** B is true: markets promote autonomy of business partners

   C. Market mechanisms for contracting tasks assume that any *relevant* heterogeneity among the bidders with respect to task descriptions has been adequately addressed

   > **Solution:** C is true: it would be inappropriate to compare competitive bids if they were about different tasks, although of course each bidder might realize the same tasks in different ways: hence, the emphasis on *relevant*

   D. The present state of affairs in IT where programming languages deal with objects, databases with tuples, and applications exchange documents provides the ideal way to realize IT systems

   > **Solution:** D is false: the resulting "impedance mismatch" leads to a lot of busy work in translating across these representations

   E. One thing we know for sure is that we don't have to contend with heterogeneity within the same enterprise

   > **Solution:** E is false: heterogeneity is endemic in any enterprise large enough and old enough to have independently designed information system modules such as databases and applications

2. (18 points) Of the following statements, identify all that hold about XSLT

   A. Because XSLT is all about altering document structure, it is not possible to have an XML Schema for XSLT

   > **Solution:** A is false: XSLT does have an XML Schema because XSLT documents are XML documents

   B. XSLT epitomizes the imperative style of programming

   > **Solution:** B is false: XSLT is not about changing variables representing program state as in, say, Fortran or Cobol

   C. In XSLT, if a template is specified with parameters, values must be explicitly specified when that template is invoked

   > **Solution:** C is false: parameter values are empty node sequences by default

D. The deep copy of an element (expressed appropriately in XSLT) fails to terminate whenever there are cycles, and that can happen in the more complex XML documents

Solution: D is false: no cycles in XML documents as such

E. In XSLT, the default behavior for any text node that is encountered is to copy it to the output

Solution: E is true: that is the effect of the built-in template (if not overridden)

F. Each XSLT template must specify the unique node on which it applies

Solution: F is false: a template would generally apply to more than one node in a document

G. When an XSLT template matches a node, that node is treated as the context node for determining any output and further actions of the given template

Solution: G is true:

H. If XSLT didn't include the copy-of construct, we could achieve its effect through copy and the remaining constructs

Solution: H is true:

I. It is possible to write XSLT stylesheets that fail to terminate on some inputs

Solution: I is true:

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. In mapping XML to tables, sometimes you would create a table with no columns

Solution: A is false: impossible in the relational model; also notice that we are not trying to store one XML document instance in a relational DBMS, but a family of XML documents

B. In mapping XML to tables, sometimes you would be forced to create a table that has no primary or candidate key

Solution: B is false: impossible in the relational model: there is always a superkey

C. If we map a relational table into an XML document, we are forced to take the risk of allowing duplicate tuples even if that was not our intent in the original table

Solution: C is false: we can state unique constraints to prevent duplicates among tuples mapped to XML elements

D. The unique element limits us to one field subelement

Solution: D is false: no such limitation for unique

E. Since XML documents may have arbitrarily many repetitions, any mapping of XML to tables without duplicates is impossible

Solution: E is false: we can introduce additional columns to distinguish different copies of an XML element

F. Since document order of elements in XML documents is significant and the ordering of tuples in the relational model is not significant, mapping of XML documents to tables is possible only if we know that document order is not significant in the particular case at hand

Solution: F is false: we can introduce additional columns to capture, if necessary, the ordering information from an XML document

G. This course advocates building a conceptual model (e.g., using UML) for the desired documents before creating XML Schema representation for them

Solution: G is true:

H. The data-centric view is better than the document-centric view for sharing well-structured information

Solution: H is true: the cleaner the structure the better the data-centric view is

I. The document-centric view is better than the data-centric view for storing information for subsequent access to establish regulatory compliance

Solution: I is true: in general, the explicit representation facilitates establishing regulatory compliance

J. A tuple-generating element is an element in an XML document schema that is mapped to a table in a relational schema

Solution: J is true: the “contents” of the TGE become the tuples in that relation

K. XML databases can naturally support key integrity constraints but not domain-specific constraints in general

Solution: K is false: use XQuery or SQL/XML queries to state additional constraints

L. In general, when we map an XML schema to a relational schema using one of the simple tuple-generating element approaches, we might not be able to map an XML key to a relational key constraint in any of the resulting relations

Solution: L is true: each relational key is limited to one table but an XML key can refer to subelements of the element on which it is asserted

M. A major practical motivation behind the interest in SQL/XML is the huge installed based on relational databases

Solution: M is true:

N. SQL/XML provides mappings between SQL types (such as date) and XML Schema

> **Solution:** N is true:

O. If an SQL/XML query output any XML, what it outputs is a well-formed XML document

> **Solution:** O is false: the output is often a forest; only in special cases is it a single document or tree

P. XML cannot be used to express sell and buy bids because bids are based on money, not on describing data

> **Solution:** P is false: XML can be used to represent any information item

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

A. Prices don't have to be in any currency: they could be expressed in any unit; all that matters is that we can determine which of two unequal prices is greater

> **Solution:** A is true: a total order is what we need

B. The efficiency of a market mechanism refers to its ability to yield Pareto optimality

> **Solution:** B is true:

C. A market mechanism satisfies *rationality* if it ensures that, assuming their bids are correct, sellers and buyers would trade only if they benefit from the trade

> **Solution:** C is true:

D. An auction that sets the price as the M^{th} lowest price is incentive compatible for sellers

> **Solution:** D is false: the M^{th} lowest price may be the price a matching seller bids: e.g., consider one seller and one buyer

E. A rational agent participating in an incentive compatible mechanism would reveal its true valuations

> **Solution:** E is true: that is the idea of incentive compatibility

F. Incentive compatibility is an important criterion when serious goods such as wheat are being traded, not for frivolous good such as music (which you can usually get for free)

> **Solution:** F is false: incentive compatibility has to do with valuations, not with seriousness or frivolity

G. Although $(M+1)^s t$-price auctions are incentive compatible for buyers each bidding to buy one item, they are not incentive compatible for buyers who place more than one bid

> **Solution:** G is true: $(M+1)^s t$-price auctions are incentive compatible for single-unit buyers but not for multiunit buyers: the latter's payoff can depend upon what they bid

H. Prices work in markets under the assumption that each agent values a larger amount of money no less than a smaller amount of money

> **Solution:** H is true: valuation of money is monotonic

I. If Alice values a book she owns at \$50 and Bob values the same book at \$60 and doesn't own it, then if Alice sells the book to Bob for \$51, the result is Pareto optimal

> **Solution:** I is true: no more gains from trade are possible

J. If Alice values a book she owns at \$50 and Bob values the same book at \$60 and doesn't own it, then if Alice's parents make her sell the book to Bob for \$15, the result is not Pareto optimal

> **Solution:** J is false: no more gains from trade are possible; the fact that Alice was coerced into selling the book at a lower price than she would have liked is irrelevant: we only look at this state of affairs not any previous state of affairs

K. If Alice values a book she owns at \$50 and Bob values the same book at \$60 and doesn't own it, then if Alice sells the book to Bob for \$55, the result is not Pareto optimal because Alice will change her valuation to be above \$55

> **Solution:** K is false: we are dealing with independent private valuations; moreover, even with Alice's valuation at \$55, the allocation where Bob has the book remains Pareto optimal

L. If two agents each have the same utility function over the same finite set of goods, then the two agents would have the same preference relation over those goods

> **Solution:** L is true: utilities induce unique preference relations

M. No rational agent may be indifferent among all the choices available

> **Solution:** M is false: why not be indifferent among all choices?

N. Given lotteries L_1, L_2, and L_3, any rational agent who prefers L_1 to L_2 and is indifferent between L_2 and L_3, necessarily prefers L_1 to L_3

> **Solution:** N is true: this is one of the properties of preference and indifference we assume for rational agents

O. The Mth price is the highest price that ensures equilibrium

> **Solution:** O is true:

P. The McAfee auction may produce no trade even when both the Mth and (M+1)st price auctions would produce a trade

> **Solution:** P is true: the McAfee auction can eliminate the one trade within the equilibrium price range

Q. Assuming each bidder places no more than one bid, an auction that sets the price at the Nth highest bid is incentive compatible for sellers

> **Solution:** Q is false: consider a case where $N = M + 1$: for example, with one sell bid of $8 and buy bids of $9 and $7, the price will be $8

R. Consider an auction for an item where it is announced ahead of time that the winner will pay $100: this auction is incentive compatible for buyers and sellers because the price they pay or receive is not a function of their bids

> **Solution:** R is false: buyers with valuations greater than $100 will bid higher (unboundedly so) than their true valuations; conversely sellers with valuations smaller than $100 will bid lower than their true valuations (specifically, such sellers will bid $0)

S. An auction for a single item in which the price is set at the arithmetic mean of the third-highest and highest prices would be incentive compatible for buyers

> **Solution:** S is false: the buyer's payoff would depend on its bid; recall we know this for first price auctions and averaging in the third-price doesn't remove the dependence

T. The second-price auction for two items being sold would guarantee efficiency and be incentive compatible for sellers

> **Solution:** T is true: this is the Mth price auction since M=2 here