http://cba.unomaha.edu/faculty/mohara/web/SYSTEMS-handout-circa-p12.pdf
Above is the link for this document.

"***For every complex problem***
***there is an answer that is clear, simple, and wrong.***"
H. L. Mencken

"*Any intelligent fool can make things bigger and more complex.*
*It takes a touch of genius - and a lot of courage to move in the opposite direction*."
Albert Einstein

"*As far as the laws of mathematics refer to reality,*
*they are not certain, and as far as they are certain, they do not refer to reality*."
Albert Einstein

"*If people do not believe that mathematics is simple,*
*it is only because they do not realize how complicated life is.*"
John von Neumann

"*Not everything that counts can be counted,*
*and not everything that can be counted counts*."
Albert Einstein

"*Technological progress is like an axe in the hands of a pathological criminal*."
Albert Einstein

"*Use the right tool for the job*."
Mr. Natural

***"How did it get so late so soon?"***
Dr. Seuss

Many, but far from all, of the items outlined below (most especially outline levels IV. and V.) can be found discussed in greater depth.
**Hayden, F. Gregory. *Policymaking for a Good Society: The Social Fabric Matrix Approach to Policy Analysis and Program Evaluation*. Springer: New York, 2006. ISBN-13: 978-0387-29369-1.**
**http://www.springer.com/social+sciences/political+science/book/978-0-387-29369-1**

I. All excellent analysis focuses upon **SYSTEMS**.

A. Profit necessarily requires ***at least three systems*** ($\pi$ = TR - TC).

B. Ethics always involves ***at least a multitude*** of systems.

C. Complex socio-ecological systems necessarily engage
complex socio-technological systems.

D. One tool for managing such analysis is the Social Fabric Matrix.[1]

E. The elements of systems analysis are the focus of this outline's
level IV. [General Systems Analysis] and
level V. [Twelve Principles of Systems].
It would be wise for you to quickly read level IV. and level V. prior to
reading the very detailed level
II. [paradigm shift] and level
III. [network as a context].

II. Systems analysis requires a **paradigm shift**
away from **isolated transactions** and towards **interrelated processes**.

A. Point of view is dependent upon a system of beliefs;
and, the viewer's own system of beliefs
rarely either is inventoried or is acknowledged by the viewer.
That inventory spans at least several dimensions of point of view:
context, criteria, consequences, social, technological, ecological, and
positivist versus normative.

1. Context influences point of view.

a. What are the ***problems*** as well as
what are the feasible ***solutions*** both are altered when
the point of view is an isolated zero sum transaction versus
the point of view is a linear flow versus
the point of view is a system (e.g.,[2] with feedback loops).

2. Criteria influences point of view.

a. What are the[3] (e.g., your) metrics of "good" and of "bad"?

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[1] Hayden, F. Gregory. *Policymaking for a Good Society: The Social Fabric Matrix Approach to Policy Analysis and Program Evaluation*. Springer: New York, 2006. ISBN-13: 978-0387-29369-1.

[2] **NOTE: i.e. means that is whereas e.g. means for example.**

[3] NOTE that the word "the" is ambiguous.
Sometimes "the" means there is one and only one in a set. Other times the word "the" means there are many items in a set but that only one of those many items is used in this context. Still other times the word "the" refers not to one item but instead refers to many items as a single whole. For example, in the sentence "The visible stars of the night sky are less than all of the stars." is the word "the" used in each of its three instances with the same meaning?
In II.A.2.a. which meaning of the word "the" is used? Read carefully.

II. A. 2. a. i. For example,
how narrowly must "good" be defined
so that every increase in GDP means
an increase in "good"?

ii. See also[4] II.A.7. [positivist versus normative].

b. Systems necessarily have
competing arrays of explicit goals as well as
competing arrays of implicit goals.

i. Each goal provides a metric of good.

II. A. 2. c. **EXAMPLE: Sustainability.**
Sustainability is a buzz word with at least three very different meanings: strong sustainability, weak sustainability, and mere short term profitability.

i. **Strong sustainability**
is an infinitely repeatable process
until an exogenous force alters the system.

[I.] For example, nature on Earth appears to humans to be a system with strong sustainability.

[A.] See, *Gaia: A New Look at Life on Earth* by James Lovelock. Oxford University Press, 2000.
ISBN-13: 978-0195216745.

[B.] In contrast,
human culture as currently practiced
clearly is not strongly sustainable.[5]

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[4] NOTE: Through out this outline there will be many references to other outline levels. For example, here the reference is to level II.A.7. [positivist v. normative].

On your first read through this entire outline you will want to avoid doing any level jumping: just read straight through and solely rely upon the bracketed comment to recognize a linkage.

On your second and subsequent reads through the entire outline you would be wise to jump to the referred to level and read it in its entirety before continuing from the point of the reference. One reason an outline structure is used is to confine the scope of references. Accordingly, for example, when given the reference to the outline level II.A.7. that means you are to go read that entire level (i.e., starting at outline item level II.A.7. and read through to the end of outline item II.A.7.d.ii.[I.]).

Additionally, after the first two full reads, when you are exploring a specific outline level as your are focusing your attention on a particular segment, to understand that segment it would be wise to engage in level jumping to all referred to levels.

[5] For a graph of static limits and dynamic limits, see link in footnote 7.

II. A. 2. c. i. [II.] Does not require the assertion,
but is totally consistent with the assertion, that
human technology *can not* be
a sufficiently close substitute
for natural processes.
(e.g., baby formula *can not*
equal mother's breast milk)

II. A. 2. c. ii. **Weak sustainability**
is repeatability over a short long term
(i.e.,[6] *not* as long as an economist's[7] long run).

II. A. 2. c. ii. [I.] Weak sustainability does require the assertion
that human technology can be *at least* a
sufficiently close substitute
for natural processes
(e.g., baby formula *does* equal
mother's breast milk).

[II.] An economist's **long run** in theory,
is an indeterminate clock time:[8]
it is that period that starts when
fixed costs equal zero.

[A.] TC = FC + VC
(i.e., fixed cost plus variable cost)

[B.] Recall I.A. [systems if to be excellent
analysis] and note II.A.4.b. [when is us
v. them].

ii. **Profitable**.
In one, very narrow sense of the word sustainable, a
profitable firm is a sustainable firm. A firm is
profitable if, for the period of firm's planning horizon,
TR received equals TC paid: $\pi = TR - TC$.

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[6] **NOTE: i.e. means that is whereas e.g. means for example.**

[7] You might wish to refresh your memory of microeconomics by consulting the *Econ Slides* at the following link. http://cba.unomaha.edu/faculty/mohara/web/BLF-p12-Econ-Slides.pdf

[8] Adam Smith estimated the long run as starting at about 90 years. Joseph Schumpeter estimated the short run as lasting as long as 100 years. John Maynard Keynes observed that in the long run we all are dead. Generically, the law of contracts and the law of treaties views the maximum duration of a limited time contract or treaty as 99 years; and contracts in excess of 99 years as equivalent to in perpetuity. The Iroquois used a long run of the seventh generation of the seventh generation; assuming a generation of 19 years that would be 19 years * 14 generations, or 266 years.

II. A. 2. c. iii. [I.] Recall that economists define profit in a variety of ways. Recall specifically that economists focus on the explicit and the implicit purchase of four resources (i.e., land, labor, capital, and entrepreneurial ability) and, respectively, the four payments for those resources (i.e., rent, wages, interest, and **normal profit**).

[II.] To discuss "profitable" requires specific attention to the following.

[A.] Is a mere accounting profit (i.e., $\pi_A$) what is obtained?

[1.] In accounting's pursuit of objective it strongly tends towards tracking transactions and requires that those tracked transactions be at arm's length; but, if a value stream is sufficiently material,[9] then accounting will seek to acknowledge implicit values.

[2.] Note, II.A.7. [positivism versus normative] and note II.A.5.c. [blinders].

II. A. 2. c. iii. [II.] [B.] Whether the obtained accounting bottom line (be that an accounting profit or an accounting loss) satisfies the requirements of normal profit (i.e., $\pi_N$)?

[C.] Whether an economic profit (i.e., $\pi_A > \pi_N$) has been obtained?

II. A. 2. c. iii. [II.] [D.] Whether an economic loss (i.e., $\pi_A < \pi_N$) has been obtained?

[i.] Note II.A.5.d.i.[I.][A.]. [shut down rule].

II. A. 2. c. iii. [III.] Note particularly II.A.4. [where] and note II.A.6. [ecological] and note II.B.2. [time influences perception].

[9] Very broadly, the legal definition of material is something that is big enough that it would change the mind of a Reasonable Person (read: objective person). Also, see, II.A.2.d.ii.[IV.] [Reasonable Persons].

II. A. 2. d. Power, law, and ethics serve different functions as criteria, thus each alters point of view.

i. In this document, the words "can" and "might" will be used to identify the criteria power to act.

ii. In this document, the words "may" and "may" will be used to identify the criteria law (i.e., authorized behavior).

[I.] A legal duty may exist when you can not act (i.e., you lack the power to act).

[II.] For a ***mere* legal person** (e.g., corporation) it is correct to write that the power to act requires legal authorization (e.g., *Ultra Vires* doctrine). Accordingly, resist the temptation to write "the corporation can" rather than write "the corporation may" except in those circumstances when it is critical to distinguish an unlawful exercise of physical power to act from a lawful authority to act.

II. A. 2. d. ii. [III.] But, for a **natural person** (i.e., human) given the importance of II.A.2.d.iv. [law ≠ ethics] below it is very helpful to write "can" and "may" as appropriate for the context.

II. A. 2. d. ii. [IV.] The Law[10] uses a legal fiction: **the Reasonable Person**. All persons may reasonably expect all other persons to act like the Reasonable Person. The Reasonable Person is objective.

II. A. 2. d. ii. [V.] Economics uses a **Rational Person**. A Rational Person is hyper objective (e.g., risk neutral: see, II.B.4.c.).

iii. In this document, the words "should" and "ought" will be used to identify the criteria ethics.

[I.] **An ethical duty can not exist if you can not act** (i.e., power to act is a prerequisite of an ethical duty).

iv. While creation of law routinely is guided by ethics, what is legal is not necessarily ethical; nor *visa versa*.

[10] For an outline of major topics covered in b-law-1 see the following link. http://cba.unomaha.edu/faculty/mohara/web/BLF-p12-Memorization-Items.pdf

II. A. 2. d. iv. [I.] Creation of law
routinely is both temporally remote and
culturally remote from the
application of law
(i.e., what was ethical for "them" then is not
necessarily ethical for "us" today).

[A.] Would the preceding level be more correct to replace the word "routinely" with the word "necessarily".

[II.] <u>Law is a tool designed to accurately describe the relevant central tendency
member of a group</u>
(e.g., legal duty is reasonable relative to the Reasonable Person)
<u>but law is applied to a specific individual.</u>
(e.g., natural person within a corporation).

II. A. 2. d. iv. [II.] [A.] When all persons are acting lawfully when a corporation acts, then, legally, typically, only the corporation "acts" even though acts of multiple natural persons are necessary for that corporate action. That is, such acts of the agent *are* the acts of the principle.

II. A. 2. d. iv. [II.] [B.] Recall the difference between II.A.2.d.ii.[I.] [legal duty without power to act]
versus
II.A.2.d.iii.[I.] [ethical duty only with power to act].

[III.] Law usually focuses upon objective knowledge (i.e., either receipt of notice or reason to know) while
ethics solely focuses upon subjective knowledge (i.e., actual knowledge [a.k.a., *scienter*]).

II. A. 3. **<u>Consequences</u>**, in addition to context and criteria, influences Point of View.

a. Feasible consequences define available choices; but, what is feasible can be far more flexible than a fixed number.

i. Reality has one set of feasible consequences that do, in fact, exist.

[I.] Note, V.C. [nonisomorphic] and note V.D. [equifinality].

II. A. 3. a. ii. One's set of reasonable expectations are influenced by, but are not limited to, reality. The set of consequences that are within the set of reasonable expectations can be broader than, equal to, or less than the set of consequences of reality.

[I.] Note, II.B.4.a.v. [risk].

[II.] Note, II.B.4.f.iii. [unpredictable].

iii. Actually expected rarely is identical to reasonably expected. Actual expectation has two attributes that tend to make it a smaller set that is not drawn solely from the larger set of reasonably expected.

[I.] Actual expectations are subjective while reasonable expectations are objective. Due to variations in intelligence and variations in education, some natural persons subjectively know more and some know less than the relevant objective person (e.g., Reasonable Person; Rational Person).

[II.] Error in one's perception of reality can lead one to actually expect something that is not feasible. The subjective errors of a natural person are not identical to the objective errors.

iv. Known knowns versus
known unknowns versus
unknown knowns versus
**unknown unknowns**.

**II. A. 3. a. v. [I.] If**
**the set of**
**unknown unknowns is not a null set,**
**then**
**is the set of**
**known knowns a null set?**

II. A. 3. b. To be countable consequences
the consequences must be perceivably different.
That perception of different requires
at least three perceptions: before, cause, and after.

i.

| | | | | | |
|---|---|---|---|---|---|
| Ought we count | 0, | 1, | 2, | 3, | 4; |
| | or, | | | | |
| ought we count | 0, | 1.62, | 2.72, | 3.14, | 4.67 |
| | that is | | | | |
| count | zero | ρ | e | π | f ? |

II. A. 3. b. ii. W. Edwards Deming routinely is famously misquoted as saying "You can't manage what you can't measure." Truth be told, his sentiment was closer to: if it is important, then you can not measure it.

c. Counts is concept that distinguishes magnitude from importance: small can be critical and huge can be irrelevant.

i. Recall Einstein counting.

II. A. 4. **<u>Social perceptions</u>** influence the Point of View. At its core the question of "us" is a social question. Which is the correct point of view:
"us" **versus** "them"; or is it "us" **and** "them"?

a. *<u>Who</u>* are the "us" and who are the "them"?

i. Is a "them" necessary for there to be an "us"?

[I.] Recall II.A.3. [consequences].

ii. If the immediately preceding item II.A.4.a.i. [them necessary for an us] is true, then is the distinction between "us" and "them" specious?

b. *<u>When</u>* are "us" and when are "them"?

II. A. 4. b. i. Int**RA**-generational transfers (e.g., unemployment insurance).

ii. Int**ER**-generational transfers (e.g., physical infrastructure investments).

iii. Rule of 72: see, II.B.2. [time preference].

c. *<u>What</u>* are "us" and what are "them"?

i. Prioritization of life forms: but, recall II.A.4.a.ii. [them are us (e.g., your gut's bacteria)].

II. A. 4. d. *<u>Where</u>* are "us" and where are "them"?

i. To what extent, if any, are "us" three dimensional beings in a four dimensional time/space; and are "them" identical or different in that regard?

e. Be here now. ≈ 11! * 20! * 13! ≈ 6.0 x 10^36 meanings.

i. Note II.B.3. [synchronicity].

II. A. 5. **<u>Technological stance</u>** influences one's Point of View.

a. Definition #1: **Technology**
is a combination of idea(s) and physical embodiment(s).

b. Definition #2: **Technology**
is the feasible combination of inputs.

i. <u>Knowledge</u>
is a belief structure, a way of viewing the world.

[I.] *Facts* (i.e., see, II.A.7.c. [positivism] )
are but one of many forms of knowledge.

[II.] Recall Adam Smith's economic sources of
"labor specialization":
ability, time on task, and learning.

II. A. 5. c. ii. <u>Skills</u>
are a subset of knowledge that
are associated with intentional and efficient
generation of consequences.

iii. <u>Tools</u>
are a subset of skills.

[I.] Skills are internal to the human while
tools tend to have an attribute that is external.

[II.] To the extent of artificial intelligence,
both skills and tools can reside in
non-human locations.

II. A. 5. c. Implicit blinders (e.g., See {literally, see the film} *My Dinner with Andre*) and explicit blinders (e.g., law's rules of evidence) alter what is seen.

i. Some blinders render the observer blind, that is,
can not see (e.g., II.A.3.a.iv.; especially [I.]. [unknown unknowns])

ii. To acutely see what is seen is one function of blinders.

[I.] The professional's blinders
(e.g., thinking like a businessperson)
facilitates focus both by
minimizing distraction by low priority stimuli
and by
enhancing the visibility of high priority stimuli.

iii. Criteria of appraisal can be changed by change itself.

II. A. 5. c. iii. [I.] Action is initiated intended a consequence, however, Bounded Rationality, uncertainty, and probability, and conspire to generate *unpredictable consequences*. Note, II.B.4.f.iii. [unpredictable].

[A.] Good idea
experienced as bad consequence.

II. A. 5. c. iii. [I.] [B.] Interplay of II.A.3.a.iv.[I.] [unknown unknowns]
with II.A.5.e.i. [law can not anticipate]
with II.A.5.f.i.[III.][A.][1.] [feedback loop]; see also V.I. [feedback loops]]
with II.B.3. [synchronicity]
with III.A.1.a. [whole greater than sum of parts; see also V.F. [nonisomorphic].

II. A. 5. c. iii. [I.] [C.] For a graph of unpredictable consequences, see, *Econ Slides* mentioned in footnote 7.

[II.] *Contra*, John Rawls' ***veil of ignorance*** supports creation of coherence across full range of known feasible changes.

[A.] See, *Justice as Fairness: A Restatement* by John Rawls, a revision of his classic *A Theory of Justice*. Cambridge, Massachusetts: Belknap Press, 2001. ISBN: 978-0674005112.

II. A. 5. c. iv. ***Coherent*** criteria (i.e., stable across contexts) are superior criteria for appraisal.

[I.] Money is objective criteria rather than a coherent criteria.

II. A. 5. c. iv. [II.] As scope of consequence increases
both
the coherence of objective criteria decreases
and
social urge to use objective criteria increases.

II. A. 5. c. iv. [II.] [A.] But note, humans crave simple answers even when that simple answer is wrong.

[III.] Note II.A.5.f.i.[III] [economies of scope] and note III.C.4. [scope].

II. A. 5. d. Every technology is an *implicit value structure* (e.g., urban design tends towards automobile centric or pedestrian centric).

II. A. 5. d. i. When technological change is an "advance" depends upon the criteria;
recall I.A.7. [positivist versus normative].

[I.] Schumpeter: **creative destruction**. [11]

[A.] Economic obsolescence involves use of the ***Shut Down Rule***:
$(TR < VC) \equiv (P < AVC)$.

[1.] Old technology becomes economically obsolete when $\mathbf{AVC_{old} > ATC_{new}}$.

[2.] That is, owner of old technology replaces it with new technology when the old technology's operating expense exceeds the new technology's purchase price plus its operating expense.

[3.] Note how a non-owner of old technology buys new technology much sooner: i.e., $ATC_{old} > ATC_{new}$. This is a prime source of Capitalism's dynamism.

II. A. 5. d. i. [I.] [A.] [4.] Since economic obsolescence is, no less than partially, triggered by events external to the firm it can arrive instantaneously and/or unexpectedly.

[B] Technological obsolescence is a functional question rather than a question of cost.

[1.] Technological obsolescence is relational since each technology is nested within a network of technologies. Technological obsolescence springs from a change in the network rather than from a change in that one technology.

[11] For a summary of Schumpeter's work see the following link. *Joseph Schumpeter: Life and Work of a Great Social Scientist* by Schneider & Kuhn. Lincoln, Nebraska: UNL Bureau of Business Research, 1975. www.bbr.unl.edu/documents/joseph_a_schumpeter_book.pdf

II. A. 5. d. i. [I.] [C.] Accounting obsolescence (e.g., terminal date of straight line depreciation) is an objective forecast of useful life that might or might not be linked in any way to either technological obsolescence or economic obsolescence.

II. A. 5. d. i. [II.] Schumacher: **contextual appraisal**.

II. A. 5. d. i. [II.] [A.] Far less than most often, bigger is cheaper.

[B.] See, E.F. Schumacher. *Small is Beautiful*. Harper Perennial, 1989. ISBN: 978-0060916305.

[III.] Veblen: **conspicuous consumption**.

[A.] Value is dependent both upon context and upon reflection within that context.

[B. See, Veblen, Thorstein. *The Theory of the Leisure Class*. Introduction by John Kenneth Galbraith. Boston: Houghton Mifflin, 1973. ISBN: 9780395140086.

ii. Which **tool** attributes is/are necessary for the appraisal of change to be correct? There are three major alternative appraisal points of view: static v. dynamic; mechanical v. biological; and equilibrium v. chaotic.

[I.] Static versus dynamic.

[A.] A static appraisal tends towards a limited number of variables being allowed to change and examine that change across, at most, one full cycle.

[B.] A dynamic appraisal might allow few or many variables to change but examines that change across multiple full cycles.

II. A. 5. d. ii. [II.] Mechanical versus biological.

[A.] A mechanical appraisal, inherently, is a closed system appraisal; often asserting the assumption of certainty. See, II.B.3. [synchronicity].

II. A. 5. d. ii. [II.] [B.] A biological appraisal might be a closed system appraisal but with express acknowledgement of the environment within which an entity is embedded and interacting.

[III.] Equilibrium versus chaotic.

[A.] An equilibrium appraisal looks for and expects to see a strong tendency towards stability so that disturbances are temporary.

[B.] A chaotic appraisal both anticipates complexity of causal pathways and anticipates multiple feasible equilibria.

**II. A. 5. e. The Law can not anticipate.**

i. Reasonable expectations are by definition historical.

ii. Bounded Rationality is most acute when forecasting.

[I.] A wise person continually seeks to understand the truth in the adage "All forecasts are lucky or wrong.".

II. A. 5. f. Due to the relatively minimal constraints attributable to the physical embodiment component of technology, technology is an economically distinctive input.

i. *Within bounds that are far less bounded than is ordinary, technological change often **in**correctly is viewed as allowing economies of scale to be feasible.*

[I.] **Economies of scale** = proportional increase in <u>*all inputs*</u> generates an increase in total cost but less than a proportionate increase in average cost; so that the LRATC falls as output rises.

[A.] Recall economist's long run in II.A.2.c.ii.[II.] [long run].

II. A. 5. f. i. [II.] ***Economies of size*** = proportional increase in <u>*most inputs*</u> generates an increase in total cost but less than a proportionate increase in average cost; so that the LRATC falls as output rises.

[A.] ***MES***: minimum efficient size.

II. A. 5. f. i. [III.] [B.] Recall that in the long run the fixed costs equal zero. Accordingly, the "bigger is cheaper" segment of the LRATC curve preceding the MES point is not due fixed costs; but, might be due to lumpy costs.

II. A. 5. f. i. [III.] [C.] For a graph of the MES, see, *Econ Slides* mentioned in footnote 7.

II. A. 5. f. i. [III.] **Economies of scope** (a.k.a., ***network effect***) = proportional increase in the <u>*market(s) generating and/or market(s) receiving the inputs and/or the outputs*</u> of a market participant generates a more than proportionate decrease in LRATC of that participant's output.

II. A. 5. f. i. [III.] [A.] Within a process and across processes are linkages for obtaining inputs and sending outputs

[1.] A ***feedback loop*** connects the past status of a system part both forward to one or more system parts as well as backward to that system part's future self.

[B.] Feedback loops tend to accentuate other processes: see, V.I. [feedback loops].

[C.] Note, III.C.4. [scope].

[D.] Note, II.A.6.b.ii. [public goods].

[E.] Note, III.E. [*The Tipping Point*].

[IV.] But, recall II.A.2.c. [sustainability]; especially recall II.A.2.c.i. [strong sustainability] versus II.A.2.c.ii. [weak sustainability].

II. A. 5. f. i. [V.] In these estimations of ATC (i.e., average total cost) how broadly (e.g., II.A.2.c.i. [sustainability]) is "total" estimated?

II. A. 5. f. i. [V.] [A.] See also, III.D.5.b. [labor productivity versus total productivity]

II. A. 5. g. Mr. Natural sez "Use the right tool for the job."

II. A. 6. One's **<u>ecological frame of reference</u>** influences one's point of view. By ecological is meant the relations and interactions between organisms and their environment [e.g., habitat], including other organisms.

a. What is the priority ranking of every life form?

i. Which life forms on Earth are *sine qua non* for human life?

ii. Recall II.A.4. [us versus them] and recall II.A.5.f.i. [technology not yield scale].

II. A. 6. b. Can rape of the Earth be good stewardship?

i. ***Private goods***, generically, are notable for their typically <u>strong</u> characteristics of <u>rivalry</u> of consumption and/or <u>exclusivity</u> of possession.

ii. ***Public goods***, generically, are notable for their characteristics of externalities springing from their typically <u>muted</u> characteristics of <u>rivalry</u> and/or <u>exclusivity</u>.

I. A. 6. b. ii. [I.] An **externality** (a.k.a., <u>spillover</u>) does not register in the market as "supply" and an externality does not register in the market as "demand".

I. A. 6. b. ii. [I.] [A.] The market price of an externality is **zero price** for some fraction (?whole?) of the externality. That zero price prevents the allocative effect of the market, thereby generating excessive consumption for spillover costs and insufficient consumption for spillover benefits.

I. A. 6. b. ii. [I.] [B.] For a graph of spillovers, see, *Econ Slides* mentioned in footnote 7; the *Econ Slides* also include a discussion of productive efficiency versus allocative efficiency.

I. A. 6. b. iii. **Waste** (i.e., real property law) is a breach of a legal duty or of legal duties.

[I.] ***Waste*** is misappropriation by the current possessor/owner of the ownership rights of either concurrent or subsequent owners.

**II. A. 6. c. What is the minimum feasible number of generations for an evolutionary consequence in a life form** (i.e., what is minimally necessary fraction of total population that must carry a gene; as well as what is the relevant average fecundity)?

II. A. 6. c. i. Is it the "seventh generation of the seventh generation"?

[I.] E.g., approximately 266 years if assuming Thomas Jefferson's generational estimate of 19 years times 14 generations; or, is the 7th generation of the 7th generation approximately 350 years by assuming a 2006 USA mother's age of 25 at birth of first child.

[A.] See, II.B.2.a.iv.[I.] [penny plus 276 years equals million dollars].

ii. How does the metric "generation" vary across life forms (e.g., microbe versus human; organism versus super organism)?

[I.] Identify four existing human technologies that have generated an evolutionary consequence in some life form (e.g., antibiotic resistance).

[II.] Which technologies have done so in humans (e.g., speech has; but not [?yet?] graphs)?

II. A. 6. c. ii. [III.] Given how you answered II.A.6.c. [minimum number of generations] and II.A.6.c.ii. [metric of a generation], relative to which other life forms on Earth, moving into the future, do humans have and do humans not have an advantage over most other life forms for gaining beneficial evolutionary consequence?

[A.] How does your answer to question immediately above in II.A.6.c.ii.[II.] influence your inventory of decisions for which you personally use the II.B.4.b.i. Precautionary Principle?

II. A. 7. **<u>Positivist versus Normative</u>** approach to knowledge influences one's Point of View.

a. Recall Einstein counting and Deming managing.

b. Science strives to be positivist and science strives to minimize being normative.

c. ***Positivism*** (a.k.a., ***scientific method***) seeks to avoid values (e.g., observer bias) and instead seeks to solely focus on ***facts***.

II. A. 7. c. i. ***Facts are asserted to be objective*** (i.e., perception of a Reasonable Person) rather than to be subjective (i.e., natural person's personal perception).

II. A. 7. c. ii. ***Facts*** tend towards exhibiting consistency of perception across different observers.

[I.] Opinions are subjective; and the mean opinion has a (??detectably??) relatively larger variance compared to the mean fact's variance.

[II.] In a court of law the opinions of experts are accepted as *fact* because the opinions of experts cluster sufficiently tightly to warrant judicial acceptance as *fact*: recall, II.A.5.c. [rules of evidence].

[III.] One function of measurement **tools** is to foster this consistency since the **tool** rather than the human, does the perceiving; but, recall II.A.5.c. [blinders].

II. A. 7. d. ***Normative*** explicitly recognizes and seeks to inventory the values explicit and implicit in all *facts* (e.g., GDP, profit).

i. ***Normative asserts it is impossible to extinguish observer bias***. That is, at best can expressly manage influence of the observer bias.

ii. Normative asserts that one's ***choice of the facts is inherently normative***. Normative seeks facts as much as does positivism. How they differ is their willingness to accept the assumption of avoidance of distortions from the observer's biases (i.e., value structures).

II. A. 7. d. iii When New York Senator Daniel Patrick Moynihan, former U.S.A. Ambassador to the U.N., observed that "*Everyone is entitled to his own opinion, but not his own **facts***." was he asserting a positivist view or a normative view or both?

e. See also II.A.2.a. [criteria for "good" and for "bad"].

II. B. There are many conceptions of time; each conception of time influences what is perceived.

1. Is time a stream?

a. Is so, does that stream of time exhibit unidirectional causation (i.e., past then present then future).

b. ***Clock time*** a.k.a., *classical time*, is an artificial human abstraction created to foster positivist objective perceptions. See below, V.K. [real versus classical time].

i. Clock time has many mathematical advantages. The units of clock time are infinitely divisible and infinitely aggregatable. The range of clock time is from an infinite past across to an infinite future. C Clock time is neither necessarily unidirectional nor necessarily one-dimensional.

[I.] However, depending upon the context, real time is materially different that each of these mathematical properties.

II. B. 1. b. ii. One clear disadvantage of clock time is that the unit of clock time selected by the observer for use during an examination of reality might not bear any relationship whatsoever to the process cycles being studied.

II. B. 1. b. ii. [I.] There is a clear risk of specifying a unit of clock time that quite likely precludes the ability to perceive a process cycle being studied because the unit of clock time is vastly different (either larger or smaller) than the process cycle (e.g. study days when process cycle takes place in seconds; or study days when process cycle takes place in centuries). Recall II.A.5.c. [blinders].

II. B. 1. b. ii. [II.] Recall, II.A.7.a.ii. [choice of facts is normative].

II. B. 2. It often is said the "Time is money." In some ways and in some contexts that is true. But, money must be discounted for the dollar value of time.

a. Dollar value varies with magnitude of temporal separation.

II. B. 1. b. i. E.g., a rough estimator of the compounding process is the ***Rule of 72***. That is, 72 / i = n
Where n equals the number of periods.
The Rule of 72 gives a rough approximation of the number of periods to double a dollar value via compound interest earned; or the number of periods to halve a dollar value via compound interest owed.

[I.] That *compound period interest rate*,
i,
is written as an integer (e.g., 7.2) and
not written as a decimal (e.g., 0.072).

[A.] A $1 loan for a period of ten years at 7.2% *simple interest* would require the debtor to pay the creditor
the principal of $1 plus
the interest of $1 * 0.072 * 10; that is, a repay a total of $1.72.

[B.] A $1 loan for a period of ten years at 7.2% compound interest would require the debtor to pay the creditor the principal of $1
plus the *interest which includes interest earned on the interest* (e.g., year two's interest owed is $1.072 * 0.072, or $0.77); for a total ten year repayment of $2.00.

[1.] The formula, stated in terms of the compound interest rate is:
i = ({FV /PV}^1/n) - 1.

ii. Discounting helps answer II.A.4.b. [when are us & them].

II. B. 2. a. iii. Discounting implicitly and/or explicitly
ignores II.B.3. [synchronicity]
as well as typically
ignores III.A. [π = TR - TC];
ignores III.B. [ethics is multiple systems]; and
ignores III.C. [complex systems interacting].

II. B. 2. a. iii. [I.] The calculation of discounting is an isolated mathematical process. Discounting solely focuses on one variable's (i.e., clock time) induced change in one other variable (i.e., money). Does the discounting calculation inject zero error into the analysis when that discounting includes no normative variables?

II. B. 2. a. iv. Discounted present value routinely requires a host of implicit assumptions that rarely individually or collectively are accurate: if ever accurate (recall, II.A.5.c.iv.[I.] [money is objective rather than coherent]).

[I.] A borrower of $1 today at 7.2% compound annual interest for a period of ten years is obligated both to repay the $1 of principle and to pay $1 of interest. From the perspective of the lender, the $1 lent is doubled. From the perspective of the borrower, only half of $2 that is to be paid back is received by the borrower. Similarly, in this way, at 7.2% compound annual interest if a cost of $1.0 x 10^6 is imposed 276 years in the future but, today, that future cost only is "worth" $1.0 x. 10^-2.

II. B. 2. a. iv. [I.] [A.] When any future cost (e.g., externality) is currently estimated and discounted, *vary rarely* is a ***sinking fund*** currently created and that penny deposited so in that future 276 years hence the penny and its compounded interest earned could fully fund that future million dollar harm (e.g., II.A.4.b.ii. [intERgenerational transfers]).

II. B. 2. a. v. Note the lack of symmetry: *money often is not time*. See, II.B.3. [synchronicity].

II. B. 2. b. Which <u>when</u> is the most important time?
That is, what is the correct <u>time preference</u>?

i. Discounting
implicitly prefers the present over the future.

ii. A fully funded (i.e., both adequate initial deposits and retention of earnings) II.B.2.a.iv.[I.][A.] sinking fund *<u>might</u>* reflect a balanced time preference
rather than a biased time preference.

[I.] Visit the Pension Benefit Guarantee Corporation's web site and explore the relative frequency of persons who knowing create future liabilities simultaneously creating and fully funding related sinking funds.
www.pbgc.gov

II. B. 2. b. iii. Given II.A.3.a.iv.[I.] [unknown unknowns], use of the II.B.4.b.i. [Precautionary Principle] might be required to demonstrate a balanced rather than a biased time preference.

**II. B. 3. Synchronicity is**
**the essence of the paradigm shift**
**from isolated transactions to interrelated transactions.**
**Synchronicity is**
**multiple constraint optimization as opposed to**
**single factor optimization**
**(e.g., total factor productivity versus labor productivity).**
**Synchronicity requires**
**sequencing, punctuality, duration, and coordination.**

a. *<u>Sequencing</u>* of process inputs and outputs is necessary for synchronicity.

i. Time of sequencing is certain to be multi-dimensional: linear time, cyclical time, ***and/or*** alternating time.

[I.] <u>Linear time</u> (??most often??) is unidirectional time;
see, II.B.1. [stream of time].

[II.] <u>Cyclical time</u> is measured by a process cycle (e.g., Earth's seasons). Both interconnected networks (e.g., V.I. [feedback loop]) and unconnected parallel processes may share a cyclical time.

II. B. 3. a. i. [II.] [A.] For example, one means of detecting effects of **global warming** is de-synchronization of temporally and geographically seasonal processes. The Earth's position relative to the Sun, across eons of cycles, has tightly correlated three variables: minutes of daylight, intensity of solar radiation at the surface, and air temperature. Different life forms have evolved to respond to different solar variables more central to their existence. Global warming disturbs the correlation of air temperature with daylight and solar intensity; which, in turn, disrupts the synchronization of interrelated population attributes. For example, the spring surge in worm population no longer is cyclically timed to coincide with the spring surge in birth of birds (i.e., air warms faster than ground). This disconnect in the first disturbed cycle causes a higher survival rate for worms and lower survival rate for birds. Subsequent cycles will experience echoes of the original disturbance as well as any then current disturbance of that future cycle. Note how this example also is applicable to the II.B.3.b. [punctuality] requirement as well as note II.B.3.e. [cascading failures].

II. B. 3. a. i. [III.] <u>Alternating time</u> exhibits a contextually defined directionality of time. For example, the information flow of a feedback loop might base current action at one network node upon that node's forecast of the future status for another node. That is, in order to synchronize production and deliveries future needs must be anticipated (i.e., information flows from the future to the present) given the stream of time constraints on physical production.

b. <u>*Punctuality*</u> of process inputs and outputs related to windows of opportunity within individual nodes and across networks of nodes.

II. B. 3. b. i. Wind power is solar power.
As sun rise moves across the surface of the Earth the night versus day temperature differential creates wind. Accordingly, the probability distribution of the intensity of local wind tends toward a bimodal distribution at the edges of sunlight. In contrast, electricity use, along with a host of other human behaviors, is concentrated during sustained sun light. Since electricity is expensive to store, wind power is most efficient when wind generation of electricity is temporally paired with consumption. Wind power is not punctual: unless it is stored (i.e., money is time).

II. B. 3. c. <u>*Duration*</u> of process inputs and outputs can be too short, just right, or too long.

i. Electricity generation and electricity consumption (e.g., storage) both are instantaneous. Storage as a form of consumption is a transformation of duration.

d. <u>*Coordination*</u> of process inputs and outputs means significance is not solely measured by quantity. Significance springs from the process relationships within which the inputs and the outputs exist.

e. A failure to achieve synchronicity can trigger ***cascading failures*** in multiple interrelated systems. See also, V.I. [feedback loops].

II. B. 4. Different persons have different preferences related to risk. An individual person has different preferences related to risk in different contexts. Three major differences in **risk preference** are: risk averse, risk neutral, and risk seeking.

a. Speaking technically, "uncertainty" does not equal "probability"; nor does "uncertainty" equal "risk".

i. Rarely will you encounter a human who consistently speaks technically about hazard, reward, uncertainty, probability, and/or risk; instead humans routinely and erroneously substitute one for the other. You will need to listen careful and think clearly to perceive accurately the communication that was intended.

ii. *Hazards* and *rewards* are consequences. **Hazards** are a negative consequence. **Rewards** are a positive consequence.

II. B. 4. a. iii. ***Uncertainty*** (duh!) is a lack of certainty:
that is,
a context where
**it is not possible either to identify**
the different feasible **consequences or**
it is **not possible to measure**
the relative **frequency** of the different consequences.

[I.] Recall II.A.3.a.i.[I.] [unknown unknowns].

[II.] Some assert that randomness is a prerequisite for certainty and probability.

[A.] See, II.B.4.f.i. [random]; and see, II.B.4.f.i.[II.].[A.] [random distribution].

II. B. 4. a. iii. [III.] Given the implicit definition of certainty in II.B.4.a.iii. is there always uncertainty? Recall, II.A.3.a.i.[I.] [unknown unknowns].

[IV.] When the assertion is made that "random is a prerequisite for uncertainty" which II.B.4.f.i [random] definition is used: no pattern or a normal curve? Is using the normal curve when there is no pattern one source of the II.B.4.e. [Black Swan]?

II. B. 4. a. iv. ***Probability*** exists when it is both
possible to identify the different consequences
*and*
possible to measure the relative frequency
of the different consequences (e.g., likelihood).

II. B. 4. a. iv. [I.] For example, the flip of fair coin has three feasible consequences (i.e., heads, stand on edge, and tails) with knowable probabilities. In contrast, necessarily, global warming is uncertain because the full inventory of consequences is neither knowable nor are the frequencies of those consequences knowable.

v. ***Risk*** is *deviation from expected* probabilities mathematically coupled with the expected rewards and the expected hazards.

[I.] Does the Bayesian decision tree display risk, uncertainty, or neither?
http://en.wikipedia.org/wiki/Decision_tree

II. B. 4. a. v. [II.] Recall II.B.4.a.ii. [hazard and rewards] and recall that humans frequently substitute risk for hazard as well as substitute uncertainty for probability.

[III.] Recall II.B.4.a.iv. [probability]. If you use an estimate of relative frequency of estimated consequences, then that is not a genuine II.B.4.a.iv. [probability]. Accordingly, is it accurate to use the phrase "risk of global warming"?

II. B. 4. b. ***Risk Averse*** = decision maker prioritizes avoidance of large hazards. Thus, voluntary acceptance of large risks requires either (i) rewards to be disproportionately larger (if probabilities are assumed to be not alterable); or (ii) reward probabilities to be disproportionately larger (if rewards are assumed to be not alterable).

**II. B. 4. b. i.** ***Precautionary Principle*** = for major hazards shared broadly (e.g., externalities) the decision maker ought prioritize avoidance of worst case outcomes even if probabilistic assessment reasonably forecasts significantly profitable risk taking for the individual decision maker and/or significantly profitable risk taking for the broader social context.

II. B. 4. b. i. [I.] Recall II.A.2.c.i. [strong sustainability] versus recall II.A.2.c.ii. [weak sustainability]; as well as recall II.A.4. [us versus them; or, us = them].

[II.] Everyone practices the Precautionary Principle per II.B.4.b.i. But, per II.B.4. [personal risk preference] of each person differs. Which hazards, which contexts, and which probabilities will provoke a given person to use the Precautionary Principle will vary widely. For example, USA President Bush43 rejected use of the Precautionary Principle in the Kyoto Treaty but embraced the use of the Precautionary Principle on WMD (weapons of mass destruction) in Iraq.

II. B. 4. b. ii Technically, risk averse requires risk *ala* II.B.4.a.v. However, the vernacular uses risk with a different meaning. The vernacular (i.e., everyday speech) use of risk averse is with a focus either on the hazard or the probability (even though there is no "probability": only an estimated frequency). Typically, the vernacular risk averse focuses upon specific hazards that are to be avoided; especially so if the estimated frequency of occurrence is particularly low and the means have variances that are to be avoided. Routinely, the vernacular use of risk preferences has more to do with psychological processes than with the technical definition of risk.

II. B. 4. c. ***Risk Neutral*** = voluntary acceptance of all risks as long as hazards and rewards track proportionally with the probabilities and the risk.

i. **Economics, seeking to be positivist, *assumes*** a rational person and then ***assumes*** all rational persons are risk neutral and ***assumes*** all natural persons act like rational persons.

II. B. 4. c. i. [I.] Based upon the flip of fair coin, what reward do you require for you to voluntarily accept your slavery as a hazard?

[A.] Are you risk neutral?

II. B. 4. c. i. [I.] [B.] Are you rational?

II. B. 4. d. ***Risk Seeking*** = decision maker prioritizes large rewards over smaller rewards, thus voluntary acceptance of larger hazards and/or large risks does not require rewards to be grow proportionately with probabilities or risks.

i. PowerBall probabilities are 1 in 2.0 x 10^8 with gross rewards rarely as good as $1.0 x 10^8; and yet very many tickets are sold at $1.0 x 10^0: who buys PowerBall tickets and why?

II. B. 4. d. ii. Why would a person be risk seeking?
Small rewards tend to be assimilated by the current context without fundamentally transforming the current context. If you win a raffle at a grade school ice cream social will that reward change you life? In stark contrast, a large reward tends to transform the current context, and that change in context is what is desired: not the large reward itself. If you win a $1.0 x 10^8 PowerBall drawing will that reward change your life? For PowerBall the explicit rewards and explicit probabilities are known so that there is no uncertainty. But, the desired transformation of context is implicit and its contribution creates uncertainty and, in turn, risk.

*II. B. 4. d. iii. Note in which ways PowerBall as an example of risk seeking incorrectly uses the concept of "risk" in the routine manner of that common error.*

*II. B. 4. d. iv. Is the word "risk" used in II.B.4.b. [risk averse] with its II.B.4.a.v. [risk] technical definition*
*or*
*with its II.B.4.a.i. vernacular definition (e.g., hazard)? Which definition of "risk" is used in II.B.4.c. [risk neutral] and in II.B.4.d. [risk seeking]?*
*Re-read each item very carefully.*
*In any one of those locations has the meaning of hazard been erroneously substituted when the word "**risk**" is used? While all knowledgeable persons use the phrase "risk averse", the vast majority of those users really mean "hazard averse" because they are not focusing upon any **deviation from the expected probabilities**.*

II. B. 4. e. A ***Black Swan*** is a low probability event with a large consequence. Accordingly, a Black Swan quite likely presents a high risk. The deviation from the expected probability is more likely because accurate estimation of low probability decreases with II.A.3.a.iv.[I.] [unknown unknowns].

II. B. 4. e. i. Error comes in many forms, two very common forms of error are Type I error and Type II error.
**Type I error** is to falsely say "True."
**Type II error** is to falsely say "False."
As an observed magnitude gets smaller it is increasingly difficult to be accurate (read: error is more likely). A II.B.4.f.i.[II.][A.] [normal curve] decreases at an increasing rate (i.e., *thin tails*). A Black Swan is the risk of a *fat tail*.

II. B. 4. e. ii. *A Black Swan can be the essence of risk* because (see immediately below the discussion of random) the expected probability distribution (i.e., normal) is not accurate (i.e., reality is fat tails versus expectation of thin tails). *However*, as discussed above in II.B.4.b.ii. [vernacular risk averse], a *Black Swan might have nothing to do with risk*, speaking technically; and, instead Black Swan merely might refer to occurrences of outliers at the expected frequency.

II. B. 4. e. iii. What are the differences in consequences between a <u>*positive*</u> *Black Swan* and a <u>*negative*</u> *Black Swan*?

II. B. 4. f. When is a system characteristic random, chaotic, or unpredictable.

i. ***What is it to be "random***?

[I.] Recall II.B.4.a.iii.[II.] [is random prerequisite for certainty and probability].

II. B. 4. f. i. [II.] **The definition of random varies** by the purpose of the definition.
Generically, random means having **no specific pattern,** purpose, or objective.
Statistically, random means of or relating to a type of circumstance or event that is described by a probability distribution. Here, *random* means a **specific statistical pattern** (i.e., normal curve).

II. B. 4. f. i. [II.] [A.] The probability distribution of the **normal curve** ranges from negative infinity to positive infinity; its mean, median, and mode are identical; the distribution is symmetrical; and the *frequency of occurrence decreases at an increasing rate of decrease* as move away from that mean = median = mode.

II. B. 4. f. ii. A system has **chaotic** characteristics when it has complexity that generates predictable simplicity (e.g., **Butterfly Effect**)?

[I.] Some assert the *Butterfly Effect* necessarily violates Newton's Laws of Motion (i.e.,
1st inertia;
2nd f=ma; and
3rd equal and opposite reaction)
and/or
violates Newton's Laws of Thermodynamics (i.e.,
1st conservation of energy;
2nd entropy in a closed system; and
3rd absolute zero not reached).

II. B. 4. f. ii. [I.] [A.] Instead, the *Butterfly Effect* functions via processes that are context dependent (e.g., $H_2O$ is solid below 0° C and is a gas above 100° C) or due to catalytic agents and feedback loops in open systems.

II. B. 4. f. ii. [I.] [B.] The **Butterfly Effect** asserts that some complex systems contain seemingly remote and minor variables whose initial states are in fact sufficiently connected to distant and major variables that small changes in the remote variable's initial state generates significant changes in the remote variables state.

II. B. 4. f. ii. [II.] ***Chaos theory*** posits that dynamic systems (simple or complex) exhibit a system characteristic of sensitivity to initial conditions; such sensitivity being very responsive to any uncertainty. That is, II.B.4.a.v. [risk] rapidly escalates and compounds across related network nodes and pathways.

[A.] Some complex systems have predictable properties, others do not.
An example of a predictable property is the *Butterfly Effect*: a major variation in consequence due to a minute variation in inputs.

[B.] Note as somewhat opposite view in *Coase's Theorem* at III.D.4.

II. B. 4. f. ii. [II.] [C.] Chaos Theory includes **Feigenbaum's Constant** of f = 4.67. Feigenbaum's Constant identifies when a system switches (e.g., increases) its number of attractors.

[1.] An attractor is a variable with a mean a probability distribution (e.g., random) about that mean.

[D.] Initially, a system will have single attractor. Upon expanding by Feigenbaum's Constant the system will switch to an oscillation between two attractors, and continue to increase the total number of attractors as the system expands by multiples of Feigenbaum's Constant (a.k.a., period doubling bifurcations).

[1.] The II.B.4.f.ii.[I.][B.] [Butterfly Effect] is one example of Chaos Theory.

[2.] Manic depression is one example of Chaos Theory as the person initially oscillates around a balanced emotional state but then switches to oscillating around a manic attractor and oscillating around a depressive attractor..

[E.] Note, see III.E. [*The Tipping Point*].

II. B. 4. f. iii. When is a system characteristic **unpredictable**?

[I.] *Uncertainty* of II.B.4.a.iii. is only one form of unpredictable.

[II.] Recall II.A.5.c.iii.[I.]: [unpredictable consequences].

[III.] For a graph of unpredictable consequences, see, *Econ Slides* mentioned in footnote 7.

[IV.] Given II.A.3.a.iv.[I.] [unknown unknowns] is predictability an erroneous perception?

[V.] Ignorance of a knowable condition (e.g., Butterfly Effect is present, is perceivable, but is not yet perceived) can render a predictable characteristic unpredictable.

II. B. 4. f. iii. [V.] [A.] Is the II.B.4.f.iii.[V.] [ignorance of knowable condition] an example of Type I error or is it an example of Type II error per II.B.4.e.i.?

iv. Recall II.A.3.a.iv.[I.] [unknown unknowns] when trying to categorize a system characteristic as random, chaotic, or unpredictable.

III. A network as a context for consequence alters the array of feasible consequences.

A. **Size of a network** is measured by number of nodes, number of feedback loops, as well as by aggregated inputs and aggregated outputs of that network.

1. Maximum size of an individual part (e.g., node; feedback loop) is exceeded by aggregation of individual parts.

a. Across multiple dimensions, ***the whole is greater than the mere sum of the parts***. See, V.C. [nonisomorphic] and V.D. [equifinality].

2. Recall relative consequences discussed in II.B.2.a.iv.[I.] [penny = million $] as well as in II.B.4.b.i. [Precautionary Principle].

B. **Scale of a network** refers to a relative magnitude that is a difference in kind attributable to a change in network parts that is a change in degree.

1. Recall II.A.5.f.i.[I.] [economies of scale] which require a proportional increase in <u>*all inputs*</u> and results in a more than proportional increase in output. Since, technically, economies of scale in reality are not feasible, typically analysis is of II.A.5.f.i.[II.] economies of size which only requires a proportional increase in <u>*most inputs*</u> to generate a more than proportional increase in output. Scale of a network is referring to an entirely different concept from economies of scale or economies of size.

III. B. 1. a. Note, however, that network scale makes the perception of economies of scale and/or economies of size both more feasible and more likely with an aggregations of units versus with individual units.

III. B. 1. b. The economic **law of diminishing marginal returns** counsels that increasing a *single input* initially might result in a more than proportional increase in total output; but beyond a certain point increases in that *single input* results in a less than proportional increase in output; and, ultimately a decrease in total output.

i. Feedback loops (both positive and negative) can perform in networks the same function as is performed by economics' law of diminishing returns.

C. **Scope of a network** refers to its expansiveness and, relative to its hosting environment the network's inclusiveness.

1. Classic definition of *network effect* springs from scope.

2. ***Proximate cause*** (i.e., reasonably foreseeable) of The Law is altered as a network's scope increases. That is, actual cause consequences both on distant processes and in distant systems become reasonably foreseeable (i.e., Bounded Rationality less tightly bound) via accurate perception of *synchronicity* across *feedback loops*.

III. C. 3. *Scope* consequences alter:
a. parts,
b. subunits,
c. aggregations of parts and of subunits, and/or
d. the whole.

III. C. 4. *Scope*, with no change in technology, can be similar in consequence to a change in II.A.5.b. [technology is the *feasible* combination of inputs).

a. *Feedback loops* can alter positively and can alter negatively what is feasible.

b. Recall all of II.A.5. [technological].

c. Recall II.A.5.c.iii.[I.][B.] [interplay];
recall II.A.5.f.i.[III] [network effect];
recall II.B.3. [synchronicity]; and
note V.I. [feedback loops].

5. The scope of network is very different from the scale of network; but, it is easy to confuse scope attributes as scale. It is true that as scope increases it is likely that scale also will increase. But, to do clear analysis it is necessary to distinguish changes in scope from changes in scale. For example, an increase in scale can be accomplished with no change in the number of feedback loops; but, an increase in scope necessarily means an increase in the number of feedback loops.

III. D. **Optimization** is a process of seeking to maximize or to minimize relative to criteria (e.g., profit maximization in competition requires cost minimization). Single factor optimization (e.g., labor productivity) is easier to accomplish than is multiple constraint optimization (e.g., strong sustainability needed for life on Earth).

1. Whose utils are to be maximized?
   a. Recall II.A.4. [us v. them; or is it us & them].
   b. Recall II.A.2. [criteria].
2. Benefit / Cost Analysis is one or many criteria.
   a. What are the implicit values expressed when the ratio is phrased as benefit/cost versus phrased as cost/benefit?

III. D. 2. b. Is the mathematical interpretation of the ratio benefit-to-cost substantially similar to the interpretation of the ratio cost-to-benefit?
If the two ratios both are 1:1 there is no difference in meaning. But, benefit:cost ratio of 1.2:1 does not mean he same thing as a cost:benefit ratio of 1.2:1. What is the difference in meaning?

3. *Pareto Optimality* (from economics):
change only is "good" if it improves one without harming any.
This is "feasible" in the stylized world of economic theory,
but is not feasible anywhere in reality.
   a. Contrast with *Pareto Principle* (from biology):
   20% of inputs (i.e., pea pods) yield
   80% of outputs (i.e., peas).

III. D. 4. *Coase Theorem*:
***if*** few transactions
***and if*** small transaction costs per individual transaction
***and if*** small transaction costs in aggregate,
***and if*** relatively free market,
***then*** *(but not so if any of the above ifs is not satisfied)*
initial allocation does not preclude efficient end allocation
via market transactions in the long run.
   a. *Coase Theorem* helps define the efficient boundary between the firm and the market.
   b. Coase Theorem is routinely ***mis***applied
   to fallaciously justify gross inequalities coupled with governmental non-response (e.g., externalities).
   c. Recall II.A.2.c.ii. [weak sustainability] and
   recall II.A.2.c.ii.[II.] [economist's long run].

III. D. 5. The Cobb-Douglas production function is an optimization.
$Y = A L^{\alpha} K^{\beta}$
where
Y = total production; A = *total factor productivity*;
L = labor; α = elasticity of labor;
K = capital; and β = elasticity of capital.

a. These elasticities are used to define economies of scale.

i. For a review of elasticities, see, *Econ Slides* mentioned in footnote 7.

b. What is the difference between *labor productivity* and total factor productivity?

III. D. 5. b. i. Recall II.A.2.c.i. [strong sustainability]
versus
recall II.A.2.c.ii. [weak sustainability];
as well as
recall III.C.4. [network scope].

c. Note, the Cobb-Douglas equation's independent variable A claims to be total factor productivity; but, the equation only includes two (i.e., labor and capital) of the four economic inputs (i.e., land, labor, capital, and entrepreneurial ability). Also, the dependent variable Y
claims to be total production. Does that mean all externalities are included in Y?

III. D. 6. **Subunit optimization** at the expense of the whole becomes a discrete source of subunit "profit".

a. A specific, well known form of subunit optimization also is known as the ***principle / agent problem***.

i. An agent's legal duty is to act instead of and on behalf of the principle. The agent has a duty of loyalty (e.g., no unauthorized conflicts of interest). However, often the principal's monitoring of the agent's actions can not detect embezzlement by the agent and/or if detectable, then the principal's remedial actions are ineffective in preventing that embezzlement, or recover less than what the agent has embezzled.

[I.] The financial meltdown of 2008 that caused the Great Recession is a direct result of multiple forms of rampant principal / agent problems in the financial services industries.

b. Subunit optimization can be explored from the perspective of ***rent seeking***.

III. D. 6. c. Recall II.A.4. [us v. them; or is it us & them] and recall II.B.4.b.i. [Precautionary Principle].

III. E. *The **Tipping Point**: How Little Things Can Make a Big Difference* by Malcom Gladwell. ISBN: 0316346624.

1. **Law of the Few**.

a. ***Connectors*** to facilitate transmission.

i. In Milgram's Omaha-to-Boston ***six degrees of separation*** a few connectors were responsible for half of the deliveries.

III. E. 1. a. ii. The age of information, paradoxically, also is the *age of isolation*.

[I.] *Immunity* to communication increases as information flow increases, especially when the flow exceeds the channel capacity.

[A.] A decrease in the cost of a mode of communication tends to trigger both an increase in the quantity of communication via that mode as well as an increase in the *immunity* of recipients via that mode.

[1.] *Fax effect* as contrasted with email's *law of plenty*.

[II.] As immunity sets in the relative importance of *word of mouth* communication increases.

[III.] Immunity is stimulated when the recipient of a communication experiences conflict between the recipient's internal word view and the external world view being communicated. Conversely, receptivity increases as the alignment increases between existing beliefs and new communications.

[A.] Note, together, increased immunity and increased receptivity tend to spawn group think.

III. E. 1. a. ii. [III.] [B.] **Group think** is a social phenomena wherein group members, regardless of the content of the new information flow, become strongly biased towards seeing confirmation of existing beliefs and strongly resistant to seeing refutation of existing beliefs. Data can clearly say "no" and yet group members see "yes".

III. E. 1. b. ***Mavens*** collect and transmit a vastly disproportionate amount of information.

i. The relative importance of *mavens* increases as *immunity* increases along with *isolation*.

c. *Salesmen* perform the function of persuasion that is necessary for adoption.

2. **Sticky concept** avoids information washout via flooding because sticky concept information is memorable.

3. **Power of Context**.

a. Environmental conditions welcome or oppose transmission (e.g., seasonality in transmission of STDs).

b. Environmental conditions signal receptivity (e.g., *broken window effect*) to some transactions (e.g., crime).

c. Group awareness and involvement preserves, cultivates, and transmits stimuli.

i. Channel capacity constrains and focuses transmissions.

ii. Channel capacity is both genetic and social.

[I.] Humans vary in the size of social group they can effectively manage. Some humans only can handle small groups (e.g., far less than 50 members) while major politicians routinely maintain over 5,000 points of contact. But, for most humans the optimal maximum size is a group of 150.

III. E. 4. The interplay of the law of few, stickiness, and the power of context control the process of ***diffusion***.

a. The sequence of adoption is innovators; early adopters; early majority; late majority; and finally laggards.

III. E. 4. b. Early adopters perform the function of *translation* of the innovators' vision into a conceptualization concordant with the main stream so that the early majority feels comfortable making the adoption decision.

5. Distance in social structures has both temporal and geographic attributes.

a. Humans are perceptions are biased towards short distances (i.e., short duration and close physical separation). In effect, this pair of biases make humans risk averse with respect to hazards that are distant in time and/or space.

**IV. General Systems Analysis (GSA) prioritizes a focus on relationships, structure, and interdependency rather than a focus on constant attributes of objects.**

**A. Openness, complexity, wholeness, hierarchy, and regulation set up those relationships, structure, and interdependence.**

**B. Within a dynamic whole a part functions differently than when the part is examined in isolation.**

V. The **Twelve Principles of Systems** are set of objects; open, not closed; nonisomorphic; equifinality; interactions; regulatory constraints; hierarchies; flow, deliveries, and sequences; feedback loops; not entropy; real time; and value based evaluation.

A. A system is a set of objects together with relationships between objects and their attributes.

1. Objects are elements (e.g., parts, subparts).

2. Attributes are properties (e.g., trigger levels and tolerance levels).

3. Relationships connect with iterations (e.g., cycles of cycles).

a. Due to our **Bounded Rationality** we are prone to tell ourselves the lie of uni-dimensionality.

i. All rational decision makers suffer from Bounded Rationality due to the infirmities of limited intellect, limited knowledge, and limited time for analysis and for decision. Accordingly, the quality of a decision is measured against the constraints of those infirmities; not against perfection.

V. B **All systems are open** (but, recall II.B.4.f.ii.[I.] [Newton's Laws of Motion and Laws of Thermodynamics] both of which require an assumption of a closed system).

1. **Openness is a flow** (i.e., typically both inputs and outputs) between the system being examined and its environment (i.e., multiple, other systems).
2. The state of a system is influenced by its flows.
3. **Environment routinely viewed as a *black box*** that is source of:
   a. Recall II.A.2.c. [sustainability]; and recall II.A.6.b.i. [private goods] versus recall II.A.6.b.ii. [public goods].
   b. Natural good production (e.g., forest);

V. B. 3. c. Natural resources (e.g., oil);

   d. Living Systems (a.k.a., Life Support Services [e.g., atmosphere]);
   e. *Sink Function* (e.g., absorb and process human pollution).
   f. NOTE: Markets rarely value these public goods (recall II.A.6.b.ii. [public goods]) and thus rarely approximate either productive efficiency or allocative efficiency (see *Econ Slides* at footnote 7).
      i. See, Lovins, Lovins, & Hawken. *Natural Capitalism: The Next Industrial Revolution*, 2000. http://www.natcap.org/sitepages/pid20.php
      ii. See, Paul Hawken. *The Ecology of Commerce*. Harper Collins, 1993. ISBN 978-0-887-30704-1.

C. Systems are ***nonisomorphic*** (i.e., whole is greater than sum of parts).
1. a.k.a., holistic.
2. Rejects reductionist thinking of objects viewed in isolation.

D. Systems stress ***equifinality***.
1. Posits multiple feasible paths rather than focus on equilibrium.
   a. Forecasting the future
      (e.g., start with an ice cube and end with ?)
      is far easier than
      forecasting the past
      (e.g., now a puddle of water having started with ?).

V. D. 1. b. Managers generally focus on the task of *backcasting*.
That is, identify a future date and future status, and then
actively constrain present and intermediate events so as
maximize the likelihood of that identified future status being
achieved by the identified future date.

2. Recall *can* versus *may* versus *should* (i.e., power v. law v. ethics)
at II.A.2.d.

3. Equifinality's multiple feasible paths is one cause of chaotic systems
and of the Butterfly Effect. Recall, II.B.4.f.ii. [chaos theory].

V. E. System components interact across cultural values, social beliefs,
personal attributes, technology, and the natural environment.

1. Cultural values
take many forms that shape perception of reality and, thus,
shape choices and shape actions.

a. E.g., Golden Rule versus invisible hand versus golden rule
(Note: there are two rules known as the "golden rule").

2. Social beliefs
(e.g., free will versus fate) often narrow one's inventory of "feasible"
consequences and choices.

3. Personal attitudes
(e.g., risk preference a.k.a., hazard preference)
can broaden, but more frequently narrows,
one's inventory of perceptions
relative to one's social beliefs defined inventory.

4. Technology influences one's point of view: recall II.A.5. through
II.A.5.f.i.[V.].

5. The Natural Environment is both
a reality external to human perception that constrains the feasible;
and,
a value structure for appraising human action.

a. For an example of
the value structure attribute of the natural environment,
which is a superior natural environment:
a wild environment (i.e., prior to human influence)
or
an environment depleted after severing human wants?

b. Recall V.B.3. [black box].

V. F. Systems operate within constraints imposed by
the system's controls and the system's regulations.

1. Magnitude of constraints vary.

a. ***Necessary***.

i. If system part #A is *necessary* for system part #B,
and if part #A is present,
then part #B might or might not be present;
but,
if part #A is absent, then part #B is absent.

ii. Recall II.A.2.b. [necessarily competing explicit and implicit system goals] and
recall II.A.3.a.iv.[I.] [unknown unknowns].

V. F. 1. b. ***Sufficient***.

i. If system part #A is *sufficient* for system part #B,
and if part #A is present,
then part #B must be present;
and if,
if part #A is absent, then part #B is absent.

c. An adequate constraint
tends to be focused on this cycle and permits a transaction
without being either a necessary or a sufficient constraint.

d. A viable constraint
is similar to an adequate constraint but tends to be focused
across multiple cycles (recall II.A.2.c. [sustainable]).

2. Subsystem linkages
provide additional venues for control and regulation.

a. The linkages between individual nodes provide pathways for flows and for feedback loops.

i. The delivery from a node, the receipt by a node,
the flow across a linkage, and
a flow within a feedback loop
all provide instances for potential measurement and
potential modulation in response to measurement in
the form of control and/or in the form of regulation.

3. Rules of control and rules of regulation
are both alterable and interactive.

V. F. 4. ***Technology***
interacts with control and regulation in a multitude of ways
(e.g., *mechanism* for control versus *alters* controls).

V. F. 4. i. Recall II.A.2. through II.A.2.d.iv.[III.] [criteria] and
recall II.A.5. through II.A.5.f.[V.] [technological] and
recall II.B.3. through II.B.3.d. [synchronicity] and
recall III.C. through III.C.4.b. [scope].

V. F. 5. Social beliefs
interact with control and regulation in a multitude of ways
(e.g., view of what is feasible
[e.g., USA racism prior to Martin Luther King]).

a. The Law assumes a Reasonable Person.
Recall the types of persons discussed in
II.A.2.d. [can, may, should *ala* power, law, ethics]; and
II.A.5.e. [law can not anticipate; reasonable expectations
necessarily are historical].

V. F. 5. b. Economics assumes a Rational Person.
Recall II.B.4.c.i. [economics seeks to be positivist via risk
neutrality].

c. Who is more likely to succumb to ***group think***?
Rank order the following types of persons by their propensity
to succumb to group think: a natural person, a legal person,
a Reasonable Person, and a Rational Person.

i. Recall, III.E.1.a.ii.[III.]. [immunity & group think].

V. G. Systems contain hierarchies.

1. Outputs of subsystems
provide inputs to other subsystems and/or systems.

2. Hierarchies increase scope of reasonably foreseeable
(i.e., proximate cause) consequences.

H. A system can be viewed via its ***flows***, its ***deliveries***, and its ***sequences***.

1. Threshold levels trigger reaction
within or outside of the system.

2. Tolerance levels when exceeded trigger transformation
within or outside of the system.

3. Recall II.B.3. [synchronicity] and
recall II.B.4.f.ii. [chaos theory] and
recall V.F.1. [magnitude of constraints vary].

V. I. ***Feedback loops*** can be positive or can be negative.

1. ***Positive feedback*** is self-reinforcing.

a. If the flow is both above the threshold and below the tolerance levels, then the feedback loop fosters growth.

i. But, positive feedback loops have a tendency towards fostering instability:
either excessive growth (e.g., population explosion) or excessive decay (e.g., population implosion).

V. I. 1. a. ii. A positive feedback loop can aggregate flow until the flow exceeds the tolerance level; potentially triggering unrestrained growth that collapses the system if that flow either consumes to exhaustion a source of inputs or produces outputs that swamp the system. See, III.B.3.e. [cascading failure].

b. Positive feedback often serves as
both intra-system and inter-system communication.

V. I. 2. ***Negative feedback*** is self-regulating and fosters goal direction.

a. The dampening consequences of a negative feedback reduce the likelihood of a run-away process.

i. Easily confused with Newton's 2nd law of thermodynamics at II.B.4.f.ii.[I.]. (but note, that requires an assumption of a closed system).

b. Positive feedback can serves as
both intra-system and inter-system communication.

V. I. 3. Stimulation of a system's feedback loops (either positive or negative) by a force external to the system can magnify the scope of consequences; feasibly triggering multiple system collapse if necessary subsystems or if sufficient subsystems either are starved of inputs or are swamped by inputs.

a. Recall III.B.3.e. [cascading failure] and
recall II.B.4.f.ii.[I.] [chaos theory] and
recall II.A.5.c.iv.[II.] [as scope increases coherence of objective criteria decreases] and
recall II.A.5.f.i.[III] [network effect] and
recall III.C. through III.C.4.b. [scope].

V. J. **Systems** foster differentiation and elaboration.

1. **Evolution towards complexity** (i.e., not entropy).

a. Note, Newton's 2nd law of thermodynamics at II.B.4.f.ii.[I.]. uses the assumption of a closed system which is contrary to open systems principle at V.B.

V. K. Systems use ***real time*** rather than *classical time*.

1. Newtonian time relies upon strict deterministic causality.
    a. Contrast with *equifinality* principle at V.D.
2. Time is a social construct rather than a natural phenomena.
    a. Focus on process *synchronicity*; not clock time.
        i. Recall II.B.3. [synchronicity].

L. **Evaluation** of a system's objects, attributes, and relationships **requires prior specification of values**.

1. Recall II.A.2. through II.A.2.d.iv.[III.] [criteria] and recall II.A.7. through II.A.7.e. [positivist versus normative].
2. System viability typically requires both *sufficiency* and redundancy.