Honolulu Community College
University of Hawai‘i
General Education
Foundations Course Designation Proposal Form
For Fall 2009 – Summer 2014

Global & Multicultural Perspectives          Symbolic Reasoning          Written Communication

The Honolulu Community College Foundations Board will review all proposals to ensure that approved courses meet Foundations Hallmarks. If clarification is needed, a Board member will contact you. If the Foundations Board and the General Education Committee approve the proposal, all sections of the course will be designated as satisfying the requirement. The course will be reviewed every five years.

1. Course information. Course Alpha PHIL Course Number 110

If the course is cross listed, please provide the cross-listing: Alpha Number

Course Title: Introduction to Logic

2. Foundations area requested. Check one.
Global & Multicultural Perspectives [ ] Symbolic Reasoning [ ] Written Communication [ ]

3. How many instructors currently teach this course? It makes a difference if there are only one or two instructors teaching this course versus ten instructors teaching this course. This question is asked to get an idea of how many instructors the department needs to communicate with to discuss this foundation course.

4. Syllabus. Submit a master syllabus. If multiple instructors teach the course and use varying texts and/or assignments, please include multiple representative syllabi for comparison. (Three is recommended.)

5. Hallmark Requirements. Provide an explanation of how each of the hallmarks for this proposed Foundation course will be satisfied. Try to completely answer how the course intends to meet each particular hallmark. Referencing assignments, tasks, and evaluations used in the course (as stated on the syllabus/my syllabi being submitted) as supporting evidence would be very helpful. See the previously submitted Religion 150 application for examples located at http://honolulu.hawaii.edu/intranet/articulation/foundations/REL150.pdf

6. Assessment. Provide a brief explanation of how the department will periodically review that this course has been meeting the Foundations Hallmarks including a description of what kinds of evidence will be collected to demonstrate this (Knowledge Survey results, sample of exam responses, writing samples, etc.). Also include a detailed description of how the department plans to have all instructors of this course share information with each other regarding how the hallmarks have been met. Please include a brief explanation of the assessment tools you will use to make this determination (such as Knowledge Surveys, Exams, Projects, Portfolios, etc.) and how you will use the results to make course improvements.

7. Signatures. The signatures of the initiator and the initiator’s Division Chair are required. The completed proposal must be routed to the Chair of the CPC before being delivered to the chair of the Foundations Board. No action on the part of the CPC is required unless the proposal also includes a new course Curriculum Action or a course modification Curriculum Action. The “routing” is a courtesy to the CPC. Signatures indicate approval/acceptance.

Initiated by: ____________________________ Ronald C. Pine
Initiator’s signature Initiator’s printed name 9/16/09 Date

Approved by: ____________________________
Division Chair’s signature
Division Chair’s printed name Date

Routed via: ____________________________
CPC Chair’s signature
CPC Chair’s printed name Date

Accepted by: ____________________________
Foundation Board Chair’s signature
Foundation Board Chair’s printed name Date
Application Questions for Foundation Hallmarks (Hallmarks in bold)
Explanatory Notes for each hallmark are at http://hono.hawaii.edu/intranet/articulation/Foundations/hallmarks.html

SYMBOLIC REASONING (FS): To satisfy the FS requirement, a course will
1. expose students to the beauty, power, clarity and precision of formal systems. How will the course meet this hallmark? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.

2. help students understand the concept of proof as a chain of inferences. How will instructors help students understand this concept? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.

3. teach students how to apply formal rules or algorithms. How will instructors meet this hallmark? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.

4. require students to use appropriate symbolic techniques in the context of problem solving, and in the presentation and critical evaluation of evidence. What symbolic techniques will be required and in what contexts? How will presentations and evaluations of evidence be incorporated into the course? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.

5. not focus solely on computational skills. What reasoning skills will be taught in the course? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.

6. build a bridge from theory to practice and show students how to traverse this bridge. How will instructors help students make connections between theory and practice? How will you assess this and provide evidence that students are meeting this hallmark?
See attached.
Request for Renewal of Philosophy 110 as an SR course

Honolulu Community College, Fall 2009

Compiled by Ronald C. Pine and Judy Sokei, Philosophy 110 instructors
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HCC campus extensions: 163, 425

Currently only two instructors teach Philosophy 110 at HCC. We collaborate extensively. See below on assessment.
SLO's From Syllabus – see attached

I. Course Description and Course Objectives and Student Learning Outcomes (from Course Syllabus)

The course develops basic techniques of analysis and an understanding of the principles and concepts involved in clear thinking. Emphasized will be logical validity, deductive and inductive reasoning, fallacious arguments, symbolic logic, and scientific method as applied to criteria of reasonable evidence.

Students will

- demonstrate an understanding of the beauty and power of symbolic systems, as well as their clarity and precision, through use of techniques of logical analysis, with the intention of enhancing reasoning skills and appreciation of abstraction, pattern recognition, and formal systems of analysis;

- demonstrate an understanding of the concept of logical proof as a chain of inferences by producing symbolic chains of inferences of their own;

- demonstrate skill in hypothetical reasoning, and gain experience in the presentation and critical evaluation of evidence;

- demonstrate an ability to use symbolic techniques and formal rules in the context of problem solving by applying symbolic analysis techniques (translating, formal proof techniques, truth tables, argument pattern recognition) both to informal (fallacies, inductive arguments) and formal reasoning.

II. Assessment and Changes since last Certification – fall 06

We have been involved in assessment since the beginning of the various assessment initiatives on campus. We have been using a knowledge survey for several years and we have been pleasantly surprised on how many students note that they are “moderately more confident” or “very confident” on accomplishing the hallmark
objectives. We have SLO’s that match the UH Foundation Hallmarks and our knowledge survey targets those hallmarks. (See attached.)

We are a small department. Only two of us teach 110. We share an office and constantly collaborate on pedagogy, exams, and curriculum. We use the same syllabus and use the same knowledge survey each semester. We are also working on creating pre-text survey so that we can better evaluate student learning via the exit knowledge survey.

We organize student tutors every semester.

We have continued to strengthen the approach to hallmark #6 – Build a Bridge from theory to practice. We have both been trained in SmartBoard technology and are developing new curriculum and student exercises that we hope will strengthen our approach to all the hallmarks. Our main goal with the use of the SmartBoard technology is to create more interactive exercises for students. We already use groups and collaborative learning techniques and we want to use the SmartBoard for students to put up their group work. Particularly relevant is to have students do formal proof work on the SmartBoard, critique and discuss the proofs, and be able to save them to web pages.
III. SR Hallmarks and Sample Content

**Hallmark 1: Expose students to the beauty, power, clarity and precision of formal systems**

Student appreciation of abstraction and formal pattern recognition for enhancing critical thinking ability is a vital part of the course. Seeing patterns of reasoning is shown to be intimately connected to logical analysis and the evaluation of evidence.

Tools of formal pattern recognition are applied throughout the course, even with content such as informal fallacies that has traditionally been thought of as more relevant to a non-symbolic critical thinking course.

Students are first shown (and must later apply to do well on quizzes and exams) that many arguments have basically the same form.

Eg. 1-1

*All people who voted for Obama in 2008 support health care reform. George the plumber did not vote for Obama in 2008. Therefore, George the plumber does not support health care reform.*

Eg. 1-2

*All people who live in the city of Honolulu also live on the island of Oahu. Kanoe does not live in the city of Honolulu. So, Kanoe does not live on the island of Oahu.*

For any x, if x is an A, then x is a B.
x is not an A.
So, x is not a B.

Most students will have an easy time seeing that the second argument as invalid but have a hard time on the first one. Abstract patterns are advertised as the secret behind the scenes so to speak.

Next, students are shown that even in informal contexts, underlying patterns can be used to evaluate reasoning and evidence. For instance, students are shown formal “recipes” to use as guides to critique arguments such as the following:

Eg. 1-3
It is wrong to believe that our troops in Iraq are there as Bush claims to assure a “transition to democracy.” Democracy? Give me a break. Creating a democracy in Iraq with all the religious factions there that have no understanding of civic debate and democratic principles is like building a plane during takeoff.

Questionable Analogy Recipe: (Students use this recipe to formally examine the above argument)

Conclusion: X is bad (Or, X is good.)

Premise #1: X is just like Y.

Premise #2: Y is bad (Or, Y is good.) (usually implied)

Label & Description: Questionable Analogy. A weak analogy is used in the premise (indicate what is being compared to what).

Argument Analysis: Presumption. Just because a creative analogy is used in the premise we should not presume that evidence is offered for the conclusion. By way of summation or introduction, creative analogies can help us understand an argument, but unless the characteristics of similarity are discussed and justified, bare analogies should not be considered evidence. Critique the specific analogy. Indicate what evidence is left out that would make the analogy stronger. Indicate how the two things being compared are dissimilar.

Eg. 1-4

"If the Supreme Court says that you have the right to (homosexual) sex within your home, then you have a right to bigamy, you have the right to polygamy, you have a right to incest, you have the right to adultery. You have the right to anything." United States Senator Rick Santorum, R-PA

Assume that Santorum's implied conclusion is: "The Supreme Court should not say that you have the right to (homosexual) sex within your home."

Slippery Slope Recipe: (Students use this recipe to formally examine the above argument)

Conclusion: Don't do A. (Most often implied.)
Premise #1: Because if we do A, then B will happen. If B happens, then C will happen. And if C happens, then D happens. (The chain here does not need to be exactly this long, but usually it at least involves an A, B, and C.)

Premise #2: D is bad (usually implied).

Label & Description: Slippery Slope. There is an unsupported slippery slope in the premises. One of the premises claims that once a first step is taken a number of other steps are inevitable.

Argument Analysis: The premise is questionable and unfair. Although the reasoning is valid, an unsupported and controversial prediction is made in the premises regarding a possible chain of causal events. Without some evidence presented to support the connections asserted in the premise, the mere assertion of a possible chain of events cannot support the conclusion. Focus on whether the premise is a reliable belief. Argue that it is at least questionable by offering evidence that the chain is not likely to happen. Point out that the argument could be stronger if inductive evidence was offered to support this premise.

Eg. 1-5

*If it were not for the liberal media that emphasizes only negative activity in Iraq and demonstrations against the war, we would be winning this war. Before the liberal media started their negative feeding frenzy and the demonstrations started, we were winning. After they started, we began to lose.*

**Questionable Cause Recipe:** (Students use this recipe to formally examine the above argument)

Conclusion: A caused B.

Premise: A happened, then B happened.

Label & Description: Questionable Cause. The conclusion asserts a causal connection between two events, but only a time sequence of those events is noted in the premise.

Argument Analysis: Reasoning. Although the premise is relevant to the conclusion, it is insufficient to support the conclusion. Make a case for a weak inductive inference by indicating that other factors were also
happening at the same time as the alleged cause. Describe what type of evidence and investigation would be needed to make the causal connection claim stronger.

Students are shown that one of the purposes of a formal analysis and a summary pattern is to avoid having to reinvent the wheel so to speak for each new argument. Once one sees the pattern repeated, then regardless of particular content, a ready made recipe exists with which to argue that the evidence for the above conclusion is weak or non-existent.

Students are also encouraged to look for patterns in recognizing inductive reasoning. They are taught that the following inference situations indicate inductive arguments:

<table>
<thead>
<tr>
<th>Premise</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>One, some, many, most</td>
<td>All</td>
</tr>
<tr>
<td>Past</td>
<td>Present</td>
</tr>
<tr>
<td>Present</td>
<td>Future</td>
</tr>
<tr>
<td>A happened, B happened</td>
<td>A caused B</td>
</tr>
</tbody>
</table>

These pattern recognition activities are viewed by the instructors of Philosophy 110 at HCC as crucial critical thinking tools, but also as introductory for the symbolic logic part of the course.

Students are taught the basics of propositional logic: translations, truth tables, and formal proofs. They are taught that isolating a symbolic syntax is a crucial first stage for examining the formal aspects of an argument, for the construction of a truth table, and finally for a formal proof. With truth tables, the concept of a variable is introduced to students. Prior to being introduced to the formal rules for proof construction, students are shown the power of argument recognition with variables. For instance, they are shown that all the following arguments have the same form.

Eg. 1-6

1. P ⊃ C
2. P ⊃ ⊃ C

1. (M ⊃ C) ⊃ ~B
2. M ⊃ C ⊃ ~B
1. \(((A \supset B) \equiv (C \lor \neg B)) \land \neg D) \supset (\neg E \lor \neg F)\)
2. \(((A \supset B) \equiv (C \lor \neg B)) \land \neg D) \therefore (\neg E \lor \neg F)\)

1. \(p \supset q\)
2. \(p \therefore q\)

Students are then introduced to Copi’s propositional logic system (19 rules). By the final exam students must demonstrate an ability to construct formal proofs. They must be able to apply the rules correctly and show minimum proficiency in deriving valid steps of reasoning. Students are taught that precision and accuracy are very important. Students who submit proofs such as the following will not pass the course.

\textbf{Eg. 1-7}

1. \(D \land \neg B\)
2. \(D \supset (C \equiv B)\)
3. \(X \supset (A \land C) \therefore \neg X\)
4. \(X \supset A\) \hspace{1cm} (3) Simp. XX
5. \(C \equiv B\) \hspace{1cm} (2) MP X
6. \(C \land A\) \hspace{1cm} (3) Com. X
7. \(D \supset (C \equiv B)\) \hspace{1cm} (2) CD X
8. \(\neg A\) \hspace{1cm} (4) MT X
9. \(\neg X\) \hspace{1cm} (4)(8) MT

Students must also learn the difference between elegant and non-elegant proofs.

\textbf{Eg. 1-8 (Actual Student Proofs)}

1. \(X \supset (T \land P)\)
2. \(T \supset X\)
3. \(\neg (X \land T) \therefore \neg X\)
4. \(T \supset (X \land T)\) \hspace{1cm} (2) Abs.+ Com.
5. \(\neg T\) \hspace{1cm} (4)(3) MT
6. \(\neg T \lor \neg P\) \hspace{1cm} (5) Add.
7. \(\neg (T \land P)\) \hspace{1cm} (6) De M.
8. \(\neg X\) \hspace{1cm} (1)(7) MT

1. \(X \supset (T \land P)\)
2. \(T \supset X\)
3. \(\neg (X \land T) \therefore \neg X\)
4. \(X \supset [X \land (T \land P)]\) \hspace{1cm} (1) Abs.
5. $\sim[X \bullet (T \bullet P)] \supset \sim X$ (4) Trans.
6. $[X \bullet (T \bullet P)] \lor \sim X$ (5) Impl.
7. $\sim X \lor [X \bullet (T \bullet P)]$ (6) Com.
8. $\sim X \lor \sim T$ (3) DeM.
9. $\sim X \supset \sim T$ (8) Impl.
10. $X \supset \sim T$ (9) DN
11. $T \supset \sim T$ (10)(2) HS
12. $\sim \sim T \supset \sim T$ (11) DN
13. $\sim T \lor \sim T$ (12) Impl.
15. $\sim X \lor [(X \bullet T) \bullet P]$ (7) Assoc.
16. $[\sim X \lor (X \bullet T)] \bullet (\sim X \lor P)$ (15) Dist.
17. $\sim X \lor (X \bullet T)$ (16) Simp.
18. $(X \bullet T) \lor \sim X$ (17) Com.
19. $\sim X$ (18)(3) DS

Homework is assigned and students write out proofs on the board such as the above for comparison. We hope to soon implement a SmartBoard for this activity. The proofs can then be saved for Internet access.

Finally, the limitations of Western logic based on Aristotelian assumptions are discussed and students are taught the basic rules of multivalued logic (fuzzy logic).

**Negation ($\sim$):** The degree of truth of $\text{not } A = 1.0 - \text{ (minus) the degree of truth of } A$.

**Example:**
"A is short" = .40 (so)
"A is \textbf{not} short" = .60

**Conjunction ($\bullet$):** The degree of truth of $A \bullet B$ = the \textbf{minimum} degree of truth of $A$ and $B$.

**Example:**
$.40 \bullet .99 = .40$

**Disjunction ($\lor$):** The degree of truth of $A \lor B$ = the \textbf{maximum} degree of truth of $A$ and $B$.

**Example:**
$.40 \lor .90 = .90$

**Conditional ($\rightarrow$):** The degree of truth of $A \rightarrow B = 1 - (A \cdot B)$ if $A$ is greater than $B$, otherwise 1.

**Examples:**
$.5 \rightarrow .4 = 1 - (.5 \cdot .4) = .9$
$.99 \rightarrow .03 = 1 - (.99 \cdot .03) = .04$
\[ \begin{align*}
1.0 \rightarrow 0.0 &= 1-(1-0) = 0 \\
0.0 \rightarrow 1.0 &= 1 \\
.5 \rightarrow .6 &= 1
\end{align*} \]

**Biconditional (↔):** The degree of truth of \( A \leftrightarrow B = (A \rightarrow B) \cdot (B \rightarrow A) \).

**Examples:**

\[ \begin{align*}
.5 \leftrightarrow .4 &= (.5 \rightarrow .4) \cdot (.4 \rightarrow .5) \\
&= [1-(.5-.4)] \cdot 1 \\
&= .9 \cdot 1 = .9 \\
.5 \leftrightarrow .6 &= (.5 \rightarrow .6) \cdot (.6 \rightarrow .5) \\
&= 1 \cdot [1-(.6-.5)] \\
&= 1 \cdot .9 = .9 \\
.2 \leftrightarrow .1 &= (.2 \rightarrow .1) \cdot (.1 \rightarrow .2) \\
&= [1-(.2-.1)] \cdot 1 \\
&= .9 \cdot 1 = .9 \\
.9 \leftrightarrow .1 &= (.9 \rightarrow .1) \cdot (.1 \rightarrow .9) \\
&= [1-(.9-.1)] \cdot 1 \\
&= .2 \cdot 1 = .2
\end{align*} \]

Throughout the exposition of the various symbolic techniques and exercises in formal pattern recognition, students are shown the underlying reasons for the derivations of these techniques. Formal reasoning and symbolic pattern recognition play an essential role in the course.

**Hallmark 2: Help students understand the concept of proof as a chain of inferences.**

Inductive reasoning is discussed briefly but students are provided with a theory of sufficient evidence and are given application examples of scientific reasoning. Students are taught the concepts of induction by enumeration, higher order inductions, representative sampling, controlled studies, and study replication. Also discussed are the relative weights of these activities in terms of strengthening inductive arguments.

Although inductive reasoning is covered, the concept of deductive proof is the paramount concept of the course. Students must demonstrate their understanding of a deductive proof by
- recognizing valid and invalid deductive arguments,
- recognizing the forms of these arguments,
- explaining why an argument is valid or invalid in writing,
- justifying the steps in a symbolic proof,
- and by constructing correct symbolic proofs of validity.

The difference between classical validity and fuzzy logical validity is also covered.

Introductory lectures cover the conceptual difference between inductive and deductive reasoning. Examples and exercises are provided.

**Eg. 2-1**

**Deductive argument:**

All liberal supported Barack Obama in the 2008 presidential election.
John Adams is a liberal.
Thus, John Adams supported Barack Obama in the 2008 presidential election.

**Inductive argument:**

After careful observation we have not seen any hummingbirds all day in this forest.
Therefore, there probably are not any hummingbirds in this forest.

Along with exercises where students must distinguish between deductive and inductive reasoning, students must also learn to recognize the parts of an argument, clearly separating premises from conclusions.

**Eg. 2-2**

#1

If you are the chief of intelligence for a tyrant, then you will always be in trouble. This is so, because if you tell the tyrant the truth and it contradicts his sense of infallibility, you will be in trouble. If you tell
the tyrant only what he wants to hear, time will inevitably expose your lies and you will be in trouble. A chief of intelligence either has to tell the truth or lie.

#2

A necessary condition for universal moral judgment is the existence of universal moral principles. But the establishment of universal moral principles is possible if and only if there is an objective method for ethical judgment. If there is one clear anthropological fact it is that of cultural relativism -- there are vast differences amongst the world's cultures as to what is considered right and wrong. So, do we really have the right to judge those societies that still practice female circumcision?

#3

Justice is justice and fairness is fairness. It does not matter that judgments of right and wrong are culturally relative. Slavery is wrong, period. It does not matter that it was once popular. We have learned over the millennia that there is no inherent difference between the so-called races of people on this planet. We have also learned that there is no inherent intellectual difference and moral worth between the sexes. It should be obvious that we do have a right to judge any culture that still practices female circumcision.

#4

Support the president and don't listen to his critics. Those who criticize the president's foreign policy, his development of a new class of offensive-deterrent nuclear weapons, and his plans to drill for oil in Alaska are just the usual suspects of left-wing crybabies who don't realize what the real world is like. It is a violent world with very real evil people in it. We will some times need to kill people before they have a chance to kill us. We need also to be more self-sufficient in terms of energy production so that we don't have to rely on people (Arab countries) who don't like us because we support Israel.

In the symbolic logic portion of the course, students must demonstrate proficiency in justifying the steps in a proof.

Eg. 2-3 (Students must justify each step that is not a premise)

1. T • (U v V)
2. $T \supset [U \supset (W \cdot X)]$
3. $(T \cdot V) \supset \neg(W \vee X) \therefore W \equiv X$ (Students must justify steps 4-9)
4. $(T \cdot U) \supset (W \cdot X)$
5. $(T \cdot V) \supset (\neg W \cdot \neg X)$
6. $[(T \cdot U) \supset (W \cdot X)] \cdot [(T \cdot V) \supset (\neg W \cdot \neg X)]$
7. $(T \cdot U) \lor (T \cdot V)$
8. $(W \cdot X) \lor (\neg W \cdot \neg X)$
9. $W \equiv X$

Students must also construct their own formal proofs and justify each step accurately.

Eg. 2-4 (Student Proof)

1. $C \supset (D \lor P)$
2. $(L \lor \neg T) \cdot [\neg T \supset (D \lor P)]$
3. $(C \lor L) \lor S \therefore (\neg D \lor \neg P) \supset S$
4. $L \supset \neg T$ \hspace{1cm} (2) Simp.
5. $[\neg T \supset (D \lor P)] \cdot (L \supset \neg T)$ \hspace{1cm} (2) Com.
6. $\neg T \supset (D \lor P)$ \hspace{1cm} (5) Simp.
7. $L \supset (D \lor P)$ \hspace{1cm} (4)(6) HS
8. $C \lor (L \lor S)$ \hspace{1cm} (3) Assoc.
9. $C \lor (S \lor L)$ \hspace{1cm} (8) Com.
10. $(C \lor S) \lor L$ \hspace{1cm} (9) Assoc.
11. $(C \lor S) \supset L$ \hspace{1cm} (10) Impl.
12. $(\neg C \lor S) \supset (D \lor P)$ \hspace{1cm} (11)(7) HS
13. $(\neg C \lor S) \supset (D \lor P)$ \hspace{1cm} (12) De M.
14. $(\neg C \lor S) \supset (D \lor P)$ \hspace{1cm} (13) Exp.
15. $(D \lor P) \supset \neg C$ \hspace{1cm} (1) Trans.
16. $(D \lor P) \supset [\neg S \supset (D \lor P)]$ \hspace{1cm} (15)(14) HS
17. $(D \lor P) \supset [(D \lor P) \supset \neg S]$ \hspace{1cm} (16) Trans.
18. $[(D \lor P) \cdot \neg(D \lor P)] \supset \neg S$ \hspace{1cm} (17) Exp.
19. $[(D \lor P) \cdot \neg(D \lor P)] \supset S$ \hspace{1cm} (18) DN
20. $(D \lor P) \supset S$ \hspace{1cm} (19) Rep.
21. $(\neg D \cdot \neg P) \supset S$ \hspace{1cm} (20) De M.

In the multivalued logic section of the course students are not required to do proofs, but they are required to understand how classical Aristotelian assumptions about truth lead to paradoxical "proofs." Students are shown how various Sorites paradoxes can be shown to be classically valid.

Eg. 2-5
If a person who is only 5 feet tall is short, then given a sequence of 999 additional persons such that starting with our 5 foot tall person, one by one is 1/32 of an inch taller than the previous person, the last person in the sequence, a little over 7 feet 6 inches tall, is also short.

Then students must understand (explaining in writing on the final exam) how non-classical assumptions about truth (multivalued logic) erase the paradox. An extended notion of deductive validity based on assuming degrees of truth is provided: A fuzzy valid deductive argument is one that does not allow for a loss of truth in going from the premises to the conclusion. The above argument is shown not be all or nothing – valid or invalid, but rather one that loses validity as the height increases.

**Hallmark 3: Teach students how to apply formal rules or algorithms**

The best fit for the hallmark of learning a mechanical and algorithmic process of rule application in Philosophy 110 is truth tables. Both classical and multivalued truth tables are covered.

**Eg. 3-1 (Classical truth functions)**

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>~p</th>
<th>~q</th>
<th>p*q</th>
<th>p∨q</th>
<th>p→q</th>
<th>p≡q</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
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<td>T</td>
</tr>
</tbody>
</table>

**Eg. 3-2 (Example of a fuzzy logic truth table)**

If  
\[ p = \text{X is not short.} \]
\[ q = \text{X is short and X is young.} \]
\[ r = \text{X is short or X is young.} \]

then we can compute the following values:

<table>
<thead>
<tr>
<th>Height</th>
<th>Age</th>
<th>X is short</th>
<th>X is young</th>
<th>( p )</th>
<th>( q )</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' 0&quot;</td>
<td>10</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>5' 1/32&quot;</td>
<td>12</td>
<td>0.99</td>
<td>0.96</td>
<td>.01</td>
<td>.96</td>
<td>.99</td>
</tr>
<tr>
<td>5' 6&quot;</td>
<td>65</td>
<td>0.80</td>
<td>0.00</td>
<td>.20</td>
<td>0.0</td>
<td>.80</td>
</tr>
<tr>
<td>6' 0&quot;</td>
<td>55</td>
<td>0.60</td>
<td>0.18</td>
<td>.40</td>
<td>.18</td>
<td>.60</td>
</tr>
<tr>
<td>6' 6&quot;</td>
<td>18</td>
<td>0.40</td>
<td>0.85</td>
<td>.60</td>
<td>.40</td>
<td>.85</td>
</tr>
<tr>
<td>7' 0&quot;</td>
<td>25</td>
<td>0.20</td>
<td>0.73</td>
<td>.80</td>
<td>.20</td>
<td>.73</td>
</tr>
</tbody>
</table>
For the latter example, the computations are done using the basic rules of multivalued logic noted above in Hallmark 1. Although there is no one assignment of degrees that can be said to be absolutely correct, fuzzy logicians talk about a "reasonable assignment of degrees" given two extremes. A typical method is to assign 0 to the lowest value and 1 to the highest value, then any intermediate value will equal the original quantitative assignment (in the case of height above) minus the lowest value divided by the difference between the lowest and highest values. The above intermediate degrees were achieved in the following way. Given that 5' equals 1 and 7' 6" equals 0 for the statement "X is short," then any intermediate height x equals 1 - [(x-5)/2.5].

Students must demonstrate that they can apply the formal truth functional rules for classical logical connectives to determine the truth function for statements and then, when statements are combined in arguments, whether arguments are valid or invalid.

Eg. 3-3 (Example of a statement from an exercise)

\[\{[X \supset (Y \supset \neg Z)] \supset [\neg (X \cdot Y) \supset Z]\} \equiv \neg ((X \supset A) \supset (B \supset Y))\]

Eg. 3-4 (Example of an argument)

1. \(X \supset (\neg Y \supset Z)\)
2. \(Y \lor X\)
3. \(\neg Y\)  \(\therefore\)  \(Z \cdot \neg Y\)

For the multivalued logic section, students are not required to examine arguments, but they are asked to calculate precise values of truth for statements.

Students are given exercises, such that using the multivalued logic interpretations of the logical connectives, they need to figure out the degree of truth, assuming that \(A = .7, B = .3,\) and \(C = .1\).

Eg. 3-5

\([(A \rightarrow B) \cdot (B \rightarrow C)] \rightarrow (\neg C \rightarrow \neg A)\)
\([(\cdot 7 \rightarrow .3) \cdot (.3 \rightarrow .1)] \rightarrow (\cdot 1 \rightarrow \cdot .7)\)
[(.7 → .3) ∗ (.3 → .1)] → (.9 → .3)
[(1-(.7-3)) ∗ (1-(.3-1))] → [1-(.9-3)]
[ .6 ∗ .8] → .4
   .6 → .4
     1 - (.6-4)
   .8

**Precision and attention to detail are emphasized as crucial.** Students are told that logicians and mathematicians are anal retentive and proud of it.

However, the rules for the logical connectives for both classical and multivalued logic are not just presented as absolutes to be learned without any background rationale. One of the main reasons for covering multivalued logic and contrasting it with classical logic is to show that logical assumptions need reasons as well and that in this case the reasons have a cultural and philosophical foundation. Different philosophical conceptions of truth are discussed and rule generation is based on the elements of this discussion. Classical logic is shown to be based on Western (Greek-Aristotelian) philosophy and Multivalued logic is shown to be based on Eastern (Buddhist) philosophy.

In propositional logic and the construction of formal proofs, students are also taught that any flaw in the application of a rule is very serious. As noted above, students are told that they cannot fulfill the UH hallmarks and pass the class if they cannot apply the rules correctly. Application of a rule is absolute. Students learn that applying a logical rule cannot just be "close" or a "nice try." Students learn that creativity can apply to proofs in terms of elegance and surprising conclusions, but the rules to produce creativity must be accurately applied.

**Hallmark 4: Require Students to Use Appropriate Symbolic Techniques**

Throughout the course students are shown how the behind the scenes patterns provide a basis for recognizing arguments (formal and informal, deductive and inductive), the elements and structure of arguments, and for distinguishing between correct and incorrect arguments. Students are shown how the recognition of patterns and the symbolic presentation of patterns provide a highly focused and rigorous method for argument analysis.
For instance, on the final exam, students must determine if the following arguments are valid or invalid.

#1  If President Bush received 51% of the vote in the 2000 election, then he was legally the president of the United States. So, if President Bush did not receive 51% of the vote in the 2000 election, then he was not legally the president of the United States.

Student Answer:

\[ \forall \Delta \because \lnot \forall \Delta \]

Invalid; common misapplication of the rule of Transposition.

#2  If America does not keep steady pressure on Muslim countries to democratize, then there will be no progress in the Middle East. So, unless America does keep steady pressure on Muslim countries to democratize there will be no progress in the Middle East.

Student Answer:

\[ \lnot S \supset \lnot P \therefore S \lor \lnot P \]

Valid; correct application of the rule of Implication.

#3  Either we have a winning football team this year and the contract for June Jones is renewed, or we don’t have a winning football team this year and the contract for June Jones is not renewed. Therefore, the contract for June Jones is renewed if and only if we have a winning football team this year.

Student Answer:

\[ (W \land R) \lor (\lnot W \land \lnot R) \therefore R \equiv W \]

Valid; correct applications of Commutation and Equivalence rules.

#4  The State of Hawaii will preserve marriage between one man and one woman, provided that it will not deprive any person of civil
rights on the basis of sex. The State of Hawaii will preserve marriage between one man and one woman. So, it will not deprive any person of civil rights on the basis of sex.

Student Answer:

\[ \sim D \implies P \]
\[ P \therefore \sim D \]

Invalid; fallacy of affirming the consequent.

#5  If we stay in Iraq, we have to spend billions of dollars on non-Christians; whereas, if we don't stay in Iraq, radical non-Christians will take over the country. We either have to stay in Iraq or not stay in Iraq. So, either we spend billions of dollars on non-Christians in Iraq or radical non-Christians will take over the country.

Student Answer:

\[ (I \implies S) \bullet (\sim I \implies T) \]
\[ I \lor \sim I \therefore S \lor T \]

Valid; correct application of Constructive Dilemma

On quizzes and the final exam, students must show that they can translate arguments presented in English into a symbolic language for analysis.

If the President of the United States (according to the Bush administration) leaks a classified intelligence document to the press, then the intelligence document can be legally leaked to the press; moreover, if an intelligence document can be legally leaked to the press, then an intelligence document is not classified. This is so, for the following reasons: If an intelligence document is classified, then it cannot be legally leaked to the press. If the President of the United States (according to the Bush administration) leaks a classified intelligence document to the press, then an intelligence document is not classified. If an intelligence document is not classified, then it can be legally leaked to the press.
P = The President of the United States (according to the Bush administration) leaks a classified intelligence document to the press.

L = The intelligence document can be legally leaked to the press.

C = An intelligence document is classified.

Student Answer:

1. C ⊃ ¬L
2. P ⊃ ¬C
3. ¬C ⊃ L \therefore (P ⊃ L) • (L ⊃ ¬C)

The limitations of particular symbolic systems are also taught and students are introduced to the notion that symbolic methods developed for a particular domain of discourse will not apply in others. One of the purposes of covering multivalued logic is to show the limitations of propositional and quantification logic in examining arguments such as:

Visibility is slightly low today.
If visibility is low, then flying conditions are poor.
Therefore, flying conditions are slightly poor today.

Venn diagrams are also shown to be limited in dealing with fuzzy sets.

**Hallmark 5: Not Focus Solely on Computational Skills**

This logic course is challenging for students primarily because rote computational activity is very limited. Students find truth tables to be the easiest symbolic process primarily because it is purely computational and involves little creativity. Computing degrees of truth with the rules for logical connectives in multivalued logic is also purely mechanical. (See examples above in the Hallmark 3 section.)

Although computational skills are not the focus of the course, students are taught the important connection between sequential logical reasoning and proficiency in mathematics. Whenever possible students are shown the logical foundation for many algebraic concepts. For instance, the connection between the concept of a variable in propositional logic (p, q, r) and algebra (x, y, z) is discussed and various rules compared. For instance, commutation in logic -- (p • q)
\( q \cdot p \) -- and commutation in mathematics -- \((x + y) = (y + x)\). The beauty and power of simple mathematical formulas are also discussed. For instance, \(2^x = y\) as applied to truth table construction of logical possibilities of truth values. Students are taught that algebra was not invented to torture them, but to save vast amounts of time, that it is simply short-hand arithmetic mixed with logical rules.

However, throughout the course students are challenged with reasoning tasks where there is not one rote answer. Many potential formal correct proofs exist for a particular argument. Different interpretations of an argument exist. Different correct symbolic translations of an argument exist. Different interpretations of an informal fallacy exist and different recipes can be attempted for an analysis.

As noted above, most important is that students are challenged to use symbolic trails of reasoning. They don’t just watch proofs being constructed or justify steps after they have been constructed. They must construct their own proofs and experience the agony and ecstasy of proof construction. Frankly, students are somewhat shocked that there is no mechanical or formulaic way of doing proofs. Here is an example of a student “protest” from the online version of the course.

“I keep hoping that there has to be some clear recipe just like what we learned in Informal Fallacies. I guess I’m thinking that it is all ‘relative’ . . . It feels so unstructured and I feel like there is no way to really ‘check your work’ . . . and know how we know if we are on the right track. I would love something structured. Is there any trick to seeing which lines go with which rules? How do I know after an hours work on just one problem if I am on the right track? I can apply the rules and create a godzillion lines, but why can’t I get the conclusion quickly?”

In this context, students are told “life is tough.” For every decision they make in life, they cannot predict deductively if this decision will insure a successful outcome. As in life, there is often no clear, “structured” way through a proof. And as in life, there is often no way to “check” your decisions as you make them until much later and after a lot of pain. They are asked to reflect on all the decisions they have made in their lives. Have they been perfect? Elegant? Or, did they “blunder forward” a lot? How do we know to do the right thing at the right time? Are decisions all relative? Our answer, as with formal proofs, is there are many paths through life that are good and many that are bad. So, the relativists are wrong. In the case of formal
proofs, some proofs are right (even though they are different) and some are definitely wrong – they have Xs. And some are amazingly elegant.

However, they are also told that preparation and a firm foundation in understanding the rules are essential for success.

Within this context students are also told the story of Andrew Wiles and Fermat’s Last Theorem \(x^n + y^n = z^n\) – no solutions when \(n\) is larger than 2). How some of the greatest mathematicians could not solve the problem and how generations of mathematicians worked on the problem for over 350 years, and how Wiles spent most of his academic career on the problem and eventually solved it.

**Hallmark 6: Build a Bridge from Theory to Practice**

The approach at Honolulu Community College is to construct a seamless connection between informal reasoning/critical thinking and formal/symbolic analysis. We believe it is a pedagogical mistake to assume or create a wall between critical thinking and formal analysis and the learning of symbolic techniques. We start with informal contexts that students are most likely to encounter in their everyday lives. We show them the patterns of reasoning that lie hidden behind the surface. We show them how these patterns can be symbolized for easy identification. We gradually turn up the heat so to speak by forcing them to understand formal recipes for fallacy analysis, then turn to full-on symbolic translation and analysis of deductive arguments. We then show them how all the formal techniques can be applied back to informal contexts.

Relevance is a major concern of every instructor at Honolulu Community College. (Note the same textbook is used for all sections.) Political speeches, advertisements, op-ed pieces, and so on are constantly scrutinized for examples for class lectures, handouts, quizzes, and exams. The *New York Times* is noted in the syllabus and students are encouraged to read more news sources and be more aware of local, national, and international issues. Quiz examples and symbolic translation examples are often taken directly from the opinion-editorial pages.

Students are shown how the basic details of argumentation learned in this course apply to the big picture. Given any act of persuasion
related to important problem solving, a rational human being
approaches it in the following way:

1. What is the structure of the Argument? What is the conclusion?
What is the evidence or premises?

2. Given that we now know the argument's structure, if the premises
are true, do they provide good reasons (valid for deductive, strong
or highly probable for inductive) for the conclusion?

3. Are the premises true? What information/evidence do we have that
would confirm the premises as true? What is the quality of that
evidence.

Students are told that we concentrate on 1 and 2 in this course. For
number 3 students are told that they need to be informed about local,
national, and international issues.

We believe that our students are provided with the opportunity of
learning a mental discipline of problem solving that will stay with them
the rest of their lives. Many examples could be given of how a bridge
is constructed from theory to practice -- from the deleterious
consequences of confusing the difference between inclusive and
exclusive disjunctions, to the cultural/philosophical influence of
deciding the foundation for truth table analysis (Western assumptions
v. Eastern assumptions about truth) -- but it is perhaps best to
address this question with a former student comment.

"This course kicked my butt. It surprised me though that I learned a
kind of thinking surgery in this course that I know I will use in my
other classes and stay with me the rest of my life. I think I leaned
(STUDENT MEANT "learned") how to do real analysis. Before when I
read something, it now seems like there was a fog between my eyes
and mind and what I was reading. I realize I was just reacting to bits
and pieces of what was being said. I wasn't really concentrating. I
was making decisions based on very superficial stuff. Now I know how
to focus, how to stay calm (I can still hear your voice, "First step, stay
calm"!), and separate the pieces. What is the argument? What is the
conclusion? What are the premises? What kind of argument is it --
deductive or inductive? Is it a simple informal fallacy? If so, what
really should be discussed? If deductive, is it valid or invalid? Does it
commit one of the formal fallacies? (I am amazed how many times
now I can see someone committing the fallacy of affirming the
consequent or denying the antecedent!) Are there any words that
need to be defined? Are the words being used fairly ("terrorism with a
global reach," "coalition of the willing," "collateral damage,"). If
inductive, is the evidence strong or weak; even if strong, what kind of
evidence would make the conclusion even stronger? I even find
myself using the symbolic logic! Just the other day I read an
unnecessarily complicated sentence in the form \(\neg(p \land \neg q)\) and
remembered right away the derivation in class and the more
straightforward statement \(p \Rightarrow q\).

One downside. I still sometimes have dreams with p's and q's in
them. And, my wife says that I am starting to sound like the guy in
the Mercedes Benz's commercial. Well I guess I will just have to tell
her that this was the Mercedes Benz of courses.

Thanks.

PS One of the reasons I still find myself dreaming of p's and q's is that
I still work occasionally on the super challenging problem. I can't
believe that more women have solved this problem than men. I plan
to get this %@*! problem before I die. I'll send it to you by e-mail,
so don't die before I do!"
Attachments:

- Syllabus for Philosophy 110

  Also see:

  http://home.honolulu.hawaii.edu/~pine/Phil110/110syllabus.htm

  and

  http://home.honolulu.hawaii.edu/~pine/logicweb/110online.htm

- Exit Knowledge Survey

  Also see:

  http://honolulu.hawaii.edu/surveys/OSMRPHL
Philosophy 110: Introduction to Logic

This class fulfills a Foundation Requirement in Symbolic Reasoning and articulates with UH Manoa's Philosophy 110 course.

Instructor: Ronald C. Pine, PhD
office: Bldg 7, Rm 625
phone: 845-9163 (& voice mail)
email: pine@hcc.hawaii.edu
web: http://home.honolulu.hawaii.edu/~pine/

Class Hrs:
• 1 hour in class = 2 hours outside class

Recommended Prerequisite:
• Should be able to read and write at the College level.
• Since the ability to comprehend what you read is a prerequisite skill in logical reasoning, students are advised to take the necessary English courses either prior to or concurrently with Phil. 110.

Texts:
• Essential Logic: Basic Reasoning Skills For the Twenty-First Century, by Ronald C. Pine
• Lecture and Text Supplements

Course Description:
• The course develops basic techniques of analysis and an understanding of the principles and concepts involved in clear thinking. Emphasized will be logical validity, deductive and inductive reasoning, fallacious arguments, symbolic logic, and scientific method as applied to criteria of reasonable evidence.

This course fulfills the Symbolic Reasoning requirement for the Foundation requirement for Honolulu Community College and the University of Hawaii at Manoa. See the Manoa General Education requirements.

Course Purpose:
• Because we live in a highly technological society, students should gain a basic understanding and appreciation of formal reasoning and its connection with the informal reasoning of everyday life. Students should also gain an understanding of the basic software foundations for our machines (computers, game consoles, cell phones, etc.), and the process of putting human thoughts into these machines. Additionally, the course is based on the assumption that the less we think critically the more someone else will think for us -- usually with the intention of manipulating us. From this point of view, logic can be viewed as a defensive tool enabling each of us to defend ourselves against the onslaught of persuasive appeals that bombard our minds daily. As such it is an important element in the development of individual potential -- enabling us to be freer and more decisive individuals.
Evaluation:

- Since this course involves a step by step introduction of material, class attendance is very important.
- There will be ten quizzes (20pts. each = 200 pts.), one exam on informal fallacies (100 pts.), and a final exam covering symbolic logic (150 pts.).
- There will be no make-ups of individual quizzes, but there will be an extra-credit-day (50 pts.) prior to the final.
- Points gained on the extra-credit-day can be used to make up the points of missed quizzes, provided that a student has a good reason for missing a quiz and has communicated that reason to the instructor.
- Also, with the exception of the "A" grade, extra credit points can be used to boost a student's final grade one letter grade.
- Regular class attendance and participation in collaboration activities are important in borderline cases.
- This will be explained further in class. The final grade will be based on a percentage of the total points as follows:

  - 100-90% = A
  - 89-80% = B
  - 79-66% = C
  - 65-55% = D
  - 54% = F, N or Inc.

- Please note that the "N" and "Inc." grades are given only for special circumstances.

Special Note: Students with disabilities may obtain information on available services online at http://honolulu.hawaii.edu/disability. Specific inquiries may be made by contacting Student ACCESS at (808) 844-2392 voice/text, by e-mail at access@hcc.hawaii.edu, or simply stopping by Student ACCESS located in Bldg. 7, Rm. 319.

Advise: How to be Successful in this Class
PHILOSOPHY 110 KNOWLEDGE SURVEY - SUMMER '09

Is this Survey being conducted at the BEGINNING or at the END of the Semester?

☐ BEGINNING of the Semester  ☐ END of the Semester

YOUR PHIL 110 COURSE:

☐ IN CLASS PINE  ☐ WEB PINE

The following survey is not a test. There are no right or wrong answers. We are interested in how well we have accomplished together the student learning outcomes for this course, so please be candid in your responses.

This information will help your instructor modify and improve the course.

Mark 1 as your response to the item if you feel you are no more confident in your understanding or skill in the area than you were at the beginning of this course.

Mark 2 as your response to the item if you feel you are moderately more confident in your understanding or skill in the area than you were at the beginning of this course.

Mark 3 as your response to the item if you feel you are very confident in your understanding or skill in the area compared to the beginning of this course.

Your skill level in area:

<table>
<thead>
<tr>
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<th>1 - No more confident</th>
<th>2 - Moderately more confident</th>
<th>3 - Very confident</th>
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<tbody>
<tr>
<td>Improvement of reasoning skills.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding of how to present evidence for a conclusion.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding of recognizing and structuring arguments (premises and conclusion)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding of why it is valuable to use symbolic techniques to examine arguments and persuasive appeals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding of the concept of a logical proof.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Understanding of the difference between inductive and deductive reasoning</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding of the difference between the reasoning of an argument and its content, and that arguments can be logically valid even though the premises are hypothetical</td>
<td>☐</td>
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</table>
Understand of the concept of a **valid logical argument** and the idea of developing a valid symbolic reasoning trail from hypothetical premises

The ability to use various symbolic techniques (recipes for informal fallacies, truth tables, formal proofs) for evaluating both formal and informal reasoning

Understanding of the difference between an **elegant and precise proof** and one that is inelegant and lacks precision

In the space below, please write any additional comments that would help improve the delivery or instruction of this course. Please discuss the distance education procedures if you are in the online course or on-campus presentation if you are in one of the on-campus courses.

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*Mahalo for completing the Knowledge Survey!*