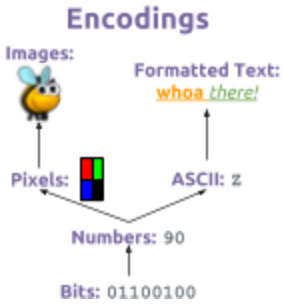
Name(s)_____ Period _____ Date _____

Practice PT: Encode an Experience

Project Description



Figuring out clever ways to encode information is one of the things computer scientists need to think about in many different contexts. There was a time before we had digital images, or music, or streaming television, or online shopping. Someone had to figure out how to encode those things in order get them onto and into computing devices. For this project you will: **Design a way to encode some human experience in binary.**

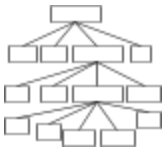
Step 1: Choose Your Experience

You should choose any type of experience you wish. Your challenge is to identify the critical aspects of that experience and determine how that can be translated into a binary encoding. You should:

- **Pick a general category of experience --** "Going to a baseball game" is the general experience, as opposed to a specific game you attended once.
- **Pick something that isn't already "digital" --** "Going to a concert" is a better choice than "making a playlist" since the second one is already primarily a digital process.
- **Pick something you have a detailed understanding of --** "Walking on the moon" is fun if you think you know enough to design that, but "Walking to school" has a lot of interesting information as well.

Step 2: Break Down Your Topic

You will create a diagram (see example on next page) that shows how you broke down your experience into pieces you could represent with ASCII or numbers (i.e. binary). This is sometimes called **Top-Down Design** - a design process that begins by specifying complex pieces and then dividing them into successively smaller, less-complex pieces.



Step 3: Develop a Detailed Encoding

Pick **one** aspect of your experience to show with detail how you would encode it in binary. You will develop a detailed encoding protocol explaining precisely how that portion of your diagram would be encoded. You will make a table that has a row for for each component that lists the following information.

Component	Type	Number of bits/range	Description / Comments
name of the component	*ASCII or Number*	*How many bits do you need? For text: how many characters?*	*Explain how/why you encoded they way you did.*

(see full example on next page)

Step 4: Written Response

Write no more than 300 words in response to this statement:

There are trade-offs when representing information as digital data.

Citing examples from this project and what you've learned so far in the course, what does this mean to you? What are the considerations that go into representing information digitally? What are the trade-offs? What's easy? What's hard? Why?

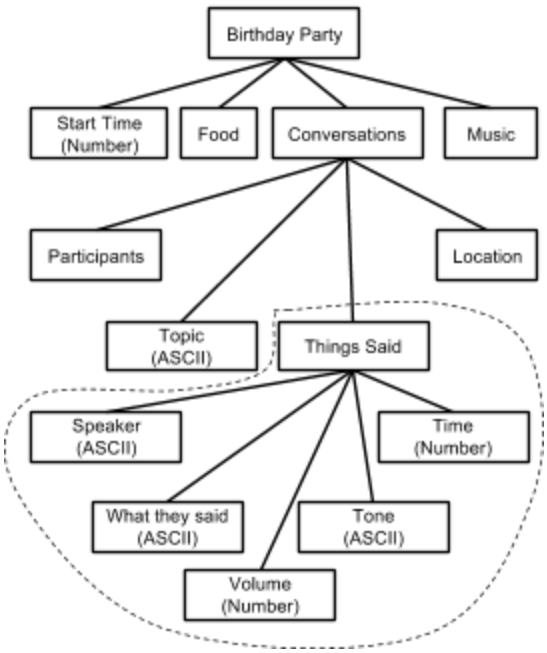
Example: encode “Attending a Birthday Party”

Here is an annotated example of how we used a top-down design strategy to encode the experience of “attending a birthday party”. Designing top-down, you **start with the experience...**

- Then think first about the **major categories** that make up that experience.
- Then **consider whether any of those components can be immediately encoded into ASCII text or numbers**.
- Then for the rest of your components **keep breaking them down into sub-parts** until a path in your design tree ends in ASCII or a number.

Your diagram will end up looking like a “tree” (see right).

Diagram: Attending a Birthday Party



The example shows how we chose to break down “Attending a Birthday Party”. We chose to include the start time, food, music, and conversations as the major categories (but there are certainly many others we could have added).

At the top level *Start Time* could be encoded as a number, but we couldn’t figure out a way to directly encode conversations, so we kept breaking it down, dividing it into *participants*, a conversation *topic*, the *things said*, and a *location*. We even decided that the *things said* would need to be further divided to truly capture the experience. Each “Thing said” at the party was broken down into pieces that could be encoded as ASCII or a Number.

Everything in the diagram represents **choices we made** about how to encode the information. There are no right or wrong answers here. A “correct” way to encode something depends on how you justify the choices you made. Here is our **detailed encoding for *Things Said.***

Things Said: Every time a person says something in a conversation their comment, question, etc. is encoded. By combining all of the “Things Said” it is possible to recreate the conversation.

Component	Type	Number of bits/range	Description / Comments
Speaker	ASCII	256 bits (0 - 32 chars)	Name of the person speaking. 32 characters should be enough for most names. It is important to know who said what.
What they said	ASCII	8000 bits (0 - 1000 chars)	The text of what the speaker said. Contains the actual contents of the conversation. I figure that a person wouldn’t speak for more than 1 minute at a time. I found out that a typical American speaks at most 150 words per minute, and on average words have 5 characters. With spaces that is 900 characters so 1000 is sufficient.
Volume	number	7 bits (0 - 127 dB)	Measured in decibels. A rock concert is 125 decibels so the range of a 7 bit number (0-127) is enough. Helps gauge how loud the party was.
Tone	ASCII	128 bits (0 - 16 chars)	How the person said something e.g. “laughing” or “serious”. This will only be a short one or two-word description to help reconstruct the tone of the conversation.
Time	number	16 bits (0-65,535 secs) (0 to 18 hours)	When the thing was said, measured in seconds since the beginning of the party. 16 bits provides (0-65,535) seconds or a little more than 18 hours (long party). This is important for knowing the order of comments.

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Encode an Experience- Submission Guidelines and Rubric

Submission Guidelines

For this project you will submit to your teacher:

1. **Your diagram** showing the breakdown of your experience
2. **Your detailed encoding** table showing the binary components of a bottom level of your diagram "tree"
3. **Your written response** about trade-offs in representing information as digital data

Project Rubric

Component	1	2	3	Score
Diagram: Complete	Few aspects of the experience have been accounted for or the diagram is incomplete.	The experience has been generally broken down but some key elements may have been missed.	The experience has been thoroughly broken down into its component parts. All critical elements have been accounted for.	
Diagram: Proper Encodings	Many components have been improperly assigned number / ASCII or should have been further subdivided.	Most components are subdivided when necessary and are reasonably assigned ASCII / number.	Components are consistently subdivided when necessary and are reasonably assigned ASCII / number.	
Detailed Encoding: Number of Bits	The encoding frequently uses an unreasonable number of bits to encode each component.	The encoding generally uses a reasonable number of bits to encode each component.	The encoding consistently uses a reasonable number of bits to encode each component.	
Detailed Encoding: Description / Comments	Most components require more explanation of how they will be interpreted or why they are included.	Some components could benefit from further explanation of how they will be interpreted or why they are included.	Nearly all components provide rich explanations of how they are interpreted and why they are included.	
Reflection: Tradeoffs in representing digital data	The response reflects an incomplete, incorrect, or trivial understanding of considerations that go into the digital representation of information.	The response reflects a partial understanding of considerations that go into the digital representation of information. Could benefit from better examples or better explanation of pros and cons.	The response reflects a deep understanding of considerations that go into the digital representation of information. Examples are cited, benefits and drawbacks are mentioned.	