Where we are:

- Functions on lists; powersets (Wednesday)
- Application: A language processor (Today)
- Propositional forms, logical equivalence [Start Chapter 3] (Monday)

Today:

- Finishing up powersets
- Case expressions and option types
- Big example: A language processor
- Introducing the semester project
Which are true?

\{3\} \in \mathcal{P}(\{1, 2, 3, 4, 5\}) \quad 3 \in \mathcal{P}(\{1, 2, 3, 4, 5\})

\{3\} \subseteq \mathcal{P}(\{1, 2, 3, 4, 5\}) \quad 3 \subseteq \mathcal{P}(\{1, 2, 3, 4, 5\})

a \in A \iff \{a\} \in \mathcal{P}(A) \quad a \in A \iff \{a\} \subseteq \mathcal{P}(A)

a \in A \iff a \subseteq \mathcal{P}(A) \quad A \subseteq B \iff A \in \mathcal{P}(B)
Which are true?

\[ \begin{align*}
A \subseteq B & \iff A \subseteq \mathcal{P}(B) \\
A & \in \mathcal{P}(A) \\
\mathbb{Z} & \in \mathcal{P}(\mathbb{R}) \\
\emptyset & = \mathcal{P}(\emptyset)
\end{align*} \]
Note that

- $a \in A$ iff $\{a\} \in \mathcal{P}(A)$

- $A \subseteq B$ iff $A \in \mathcal{P}(B)$

- $A \subseteq B$ iff $\mathcal{P}(A) \subseteq \mathcal{P}(B)$

- $\mathcal{P}(\emptyset) = \{\emptyset\} \neq \emptyset$
Observe

\[ P(\{1, 2, 3\}) = \{ \emptyset, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\} \} = \{ \emptyset, \{1\}, \{1, 2\}, \{1, 3\}, \{1, 2, 3\} \} \]

\[ = P(\{2, 3\}) \cup \left[ \text{1 added to each set of } P(\{2, 3\}) \right] = P(\{2, 3\}) \cup \left\{ \{1\} \cup X \mid X \in P(\{2, 3\}) \right\} \]

If \( a \in A \), then \( P(A) = P(A - \{a\}) \cup \{ \{a\} \cup X \mid X \in P(A - \{a\}) \} \)
What is $|\mathcal{P}(X)|$ in terms of $|X|$?
Grammar:

\[
\text{Sentence} \quad \rightarrow \quad \text{NounPhrase} \; \text{Predicate} \; \text{PrepPhrase}_{\text{opt}}
\]

\[
\text{NounPhrase} \quad \rightarrow \quad \text{Article} \; \text{Adjective}_{\text{opt}} \; \text{Noun}
\]

\[
\text{Predicate} \quad \rightarrow \quad \text{Adverb}_{\text{opt}} \; \text{VerbPhrase}
\]
Grammar, continued:

\[
\text{VerbPhrase} \rightarrow \begin{cases} 
\text{TransitiveVerb NounPhrase} \\
\text{IntransitiveVerb} \\
\text{LinkingVerb NounPhrase}
\end{cases}
\]

\[
\text{PrepPhrase} \rightarrow \text{Preposition NounPhrase}
\]
Vocabulary:

Nouns: a the

Adjectives: big bright fast beautiful smart red smelly

Nouns: man woman dog unicorn ball field flea tree

Adverbs: quickly slowly happily dreamily

Transitive verbs: chased saw greeted bit loved

Intransitive verbs: ran slept sang

Linking verbs: was felt seemed

Prepositions: in on through with
For next time:

Pg 82: 2.4.(8-12, 14 & 15)

Extra credit: Pg 91: 2.B

Note that “projects” in the book are labeled as chapter-letter, as in “2.B.” Find starter code on Schoology, and also pay attention to the assignment notes. See also the code from class for “starter code.”

Read 3.(1-4)