Answer Key: Assess of Treeformers.pdf

Final Calibrated Assessment Package

Student Version

Instructions for Students:
Welcome to your Treeformer assessment. This test is designed to evaluate your understanding of the key concepts presented. Please read each question carefully and choose the best answer.

- **Time Limit:** 1 hour
- **Total Points:** 50
- **Passing Score:** 35 points (70%)

Pre-assessment Preparation Tips:
- Review the main concepts and architecture of Treeformer.
- Focus on understanding hierarchical structures and their roles in Treeformer's functions.
- Practice analyzing and creating examples based on Treeformer's structure.

Multiple Choice Questions (1 point each, total 5 points)

1. **What is the primary inductive bias incorporated into the Treeformer architecture?**

A) Sequential processing
B) Hierarchical structure
C) Randomized encoding
D) Linear transformation

2. **Which algorithm inspired the Treeformer architecture for constructing hierarchical phrase encodings?**

A) Backpropagation
B) CKY algorithm
C) Genetic algorithm
D) Markov Chain Monte Carlo

3. **How does the Treeformer improve translation tasks according to the paper?**

A) By increasing vocabulary size
B) By enhancing random models
C) By better understanding predicate-argument structures
D) By decreasing model parameters

4. **Which specific downstream tasks showed improvement with Treeformer compared to a vanilla Transformer?**

A) Image classification and regression

B) Machine translation and abstractive summarization
C) Graph traversal and sorting algorithms
D) Text-to-speech conversion and speech recognition

5. **What does the term ‘compositional generalization’ refer to in the context of Treeformer?**

A) The ability to generalize to specific instances learned during training
B) The ability to generalize to novel compositions of known components
C) The ability to generalize across different languages
D) The ability to ignore hierarchical structures

Short Answer Questions (5 points each, total 15 points)

6. **Explain why Treeformer was specifically developed for general-purpose supervised learning rather than unsupervised parsing.**

7. **Discuss the significance of non-commutative composition functions in Treeformer's architecture.**

8. **How does the pooling function in Treeformer utilize the attention mechanism to improve representation of a phrase?**

Long Answer Questions (10 points each, total 30 points)

9. **Evaluate the impact of the maximum tree height limitation within the Treeformer on its operational efficiency and performance.**

10. **Create an argument for the inclusion of Treeformer's hierarchical approach in other types of neural network architectures not mentioned in the article.**

Instructor Version

Answer Key and Rubrics

Multiple Choice Questions:

1. **Correct Answer:** B
- **Explanation:** Treeformer architecture focuses on hierarchical structures, unlike sequential processing models.

2. **Correct Answer:** B
- **Explanation:** The CKY algorithm's parsing logic aligns with Treeformer's hierarchical encoding.

3. **Correct Answer:** C
- **Explanation:** Treeformer's ability to understand predicate-argument structures enhances translation tasks.

4. **Correct Answer:** B
- **Explanation:** These tasks benefit from Treeformer's understanding of language structure.

5. **Correct Answer:** B
- **Explanation:** Compositional generalization refers to applying known components in novel ways.

Short Answer Questions:

6. **Model Answer:** Treeformer was designed for supervised learning to utilize labeled datasets for learning structured hierarchical representations efficiently, guiding predictions with explicit data examples.

Rubric
- 3 points for complete explanation and rationale.

7. **Model Answer:** Non-commutative composition functions in Treeformer maintain the order and significance of elements in hierarchical structures, enhancing nuanced representation.

Rubric
- 3 points for in-depth discussion of its impact on representation quality.

8. **Model Answer:** Utilizing attention, Treeformer's pooling function focuses on semantically significant parts of a phrase, refining context sensitivity.

Rubric
- 3 points for clear explanation of attention mechanisms improving phrase representation.

Essay/Long Answer Questions:

Question 9 Rubric:
- Thesis Statement: 3 points
- Efficiency Analysis: 4 points
- Performance Evaluation: 3 points
- Conclusion: 2 points
- Organization: 3 points

Question 10 Rubric:
- Argument Quality: 4 points
- Examples and Applications: 4 points
- Impact Analysis: 4 points
- Conclusion: 3 points

Enhancements for Learning:

- **Self-check Before Submission:** Review your answers to ensure clarity and depth.
- **Post-assessment Reflection Prompts:** Reflect on areas of strength and growth needed with respect to understanding hierarchical architectures.
- **Follow-up Learning Activities:** Delve into practical applications of Treeformer's architecture on new language processing tasks, or explore integration into other neural network models like CNNs or GANs for a broader learning experience.

Metadata and Scoring:
- **Total Points Possible:** 50

- **Recommended Time Limit:** 1 hour
- **Passing Score Suggestion:** 35 points
- **Alignment with Learning Objectives:** Understanding Treeformer's architecture, its applications, and comparing its strengths with other models.

This complete package ensures intermediate level learners are challenged appropriately and provided a structured path from basic understanding to critical application and innovation.