# Online Learning for Min Sum Set Cover and Pandora's Box

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#### Introduction

**Context:** Stochastic optimization problems

Focus: Online version of Min Sum Set Cover (MSSC) and

Pandora's Box

Key Question: How to minimize regret in online settings?

#### Problem Definitions

#### Pandora's Box:

- Selection with unknown costs.
- Goal: Minimize selection and exploration costs.

#### MSSC:

Minimize the weighted sum of covering times for scenarios.

#### **Online Challenges:**

- Adversarially chosen scenarios.
- Regret minimization.

## Methodology

## Framework: Online Convex Optimization (OCO) [1] Steps:

- 1. Convex relaxation of problem instances [2].
- 2. Fractional solutions obtained via OCO.
- 3. Rounding fractional solutions to integral solutions [3].

## Key Results

- ▶ Single Box: 9.22-approximation no-regret algorithm [4].
- ▶ Multiple Boxes: O(1)-approximation no-regret algorithm [4].
- ► Matroid Constraints: O(log k)-approximation no-regret algorithm [4].
- ▶ **Efficiency:** Computationally efficient Algorithms.

## **Bandit Setting**

#### **Key Features:**

- Limited feedback: Only revealed values for opened boxes.
- Approximation guarantees similar to the full information setting.
- Practical for real-world scenarios.

## Comparison with Previous Work

### Improvements over [CGT+20]:

- Simpler algorithms.
- Broader applicability.

#### Advances over [FLPS20]:

- Extends to bandit settings.
- Handles more complex constraints.

## Applications and Open Questions

#### **Applications:**

- Resource allocation.
- Decision-making under uncertainty.

#### **Open Problems:**

- ► Tight bounds for MSSC.
- Extensions to dynamic settings.

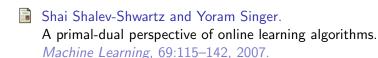
#### Conclusion

#### **Summary of Contributions:**

- Framework for online learning with MSSC and Pandora's Box [4].
- Approximation guarantees for various settings.
- Computationally Efficient Algorithms.

#### **Acknowledgments:**

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