



## Productivity Enhancement in Population Management: Optimizing Inmate Assignments to Facilities

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**World Congress on Probation and Parole**

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# OPTAMO

- Lehigh University spin-off
- Headquartered in Bethlehem, Pennsylvania
- Focus: Correctional Decision Support Solutions to optimize decision making
  - Inmate Facility Assignment
  - Specialized Housing Eligibility
  - Inmate Transportation Optimization
  - Inmate Treatment Program Scheduling
- ~10 years experience in corrections
- Existing projects in
  - Pennsylvania
  - Georgia
  - Tennessee



Daniel H. Wagner Prize, 2017



Recognized at the PA Senate and House Floor, 2017

# OPTAMO management team

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**Professor Tamás Terlaky, President**

Endowed Chair Professor, Lehigh University,  
40 years experience as an international leader in process optimization  
Professor and leader of prescriptive analytics projects in Hungary, Netherlands, Canada, USA.  
10 years experience in Corrections industry



**Dr. Mohammad Shahabsafa, CEO**

Ph.D. in Industrial Engineering  
National leader in optimizing business processes in corrections  
9 years experience in Corrections industry



**Anshul Sharma, Chief Technology Officer**

National leader in optimizing business processes in corrections  
6 years experience in Corrections industry

# IADSS Modules

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**Specialized  
Housing**



**Facility  
Assignment**



**Inmate  
Transportation**



**Program  
Scheduling**

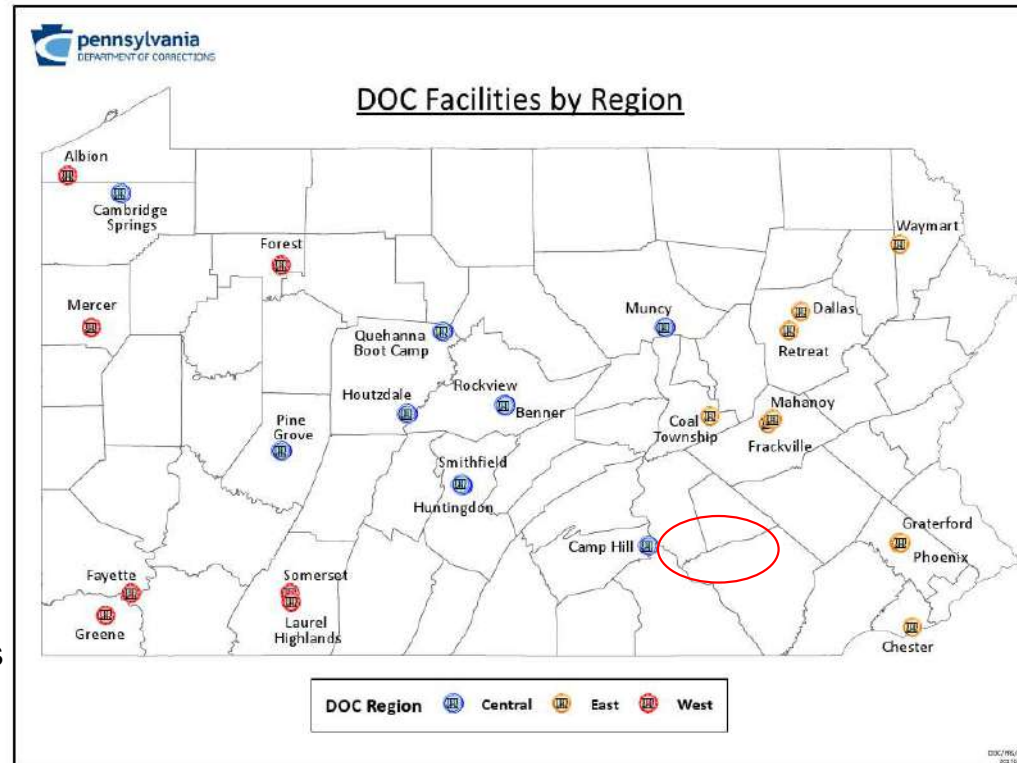


## Facility Assignment

# Pennsylvania Department of Corrections (PADOC): Implementation, Benefits & Impact

# Inmate Assignments at the PADOCC

- Done by the Office of Population Management (OPM)
- 25 SCIs
- SCI CAM: classification center
- Weekly ~250 Inmate initial assignments
- Assigned to one of the 25 SCIs
- Inmate transfers:
  - Over 80 reasons including:
    - Parole violators
    - Program placements
    - Administrative
    - Incentive based transfer
    - Etc.
- Overall: Weekly ~650 inmate assignments



Facility  
Assignment



 **ISE** Industrial and Systems Engineering



# Conventional decision making

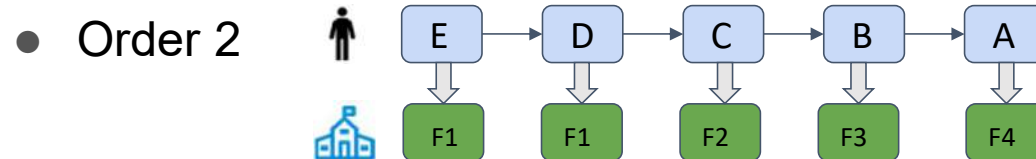
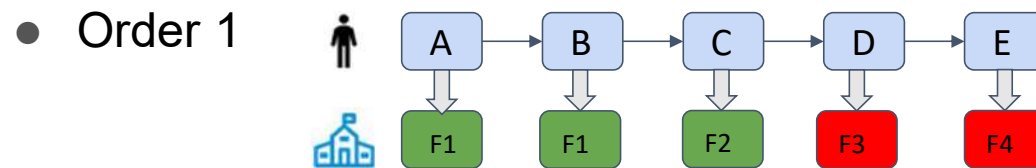
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## Manual & Sequential

- Numerous rules and policies must be considered
- Subjective
- Time-consuming
- Prone to human error
- Costly and inefficient
- Not reproducible
- Fragmented

## The order matters in sequential decision making!

- Small inmate assignment example



	F1	F2	F3	F4
Inmate A	✓	✗	✗	✓
Inmate B	✓	✗	✓	✗
Inmate C	✗	✓	✗	✗
Inmate D	✓	✗	✗	✗
Inmate E	✓	✗	✗	✗
Beds	2	1	1	1

- Finding the right order becomes extremely difficult as the number of inmates increases.
- Demonstrates **inherent problem** with sequential decision making.

# Sequential vs. Simultaneous assignment

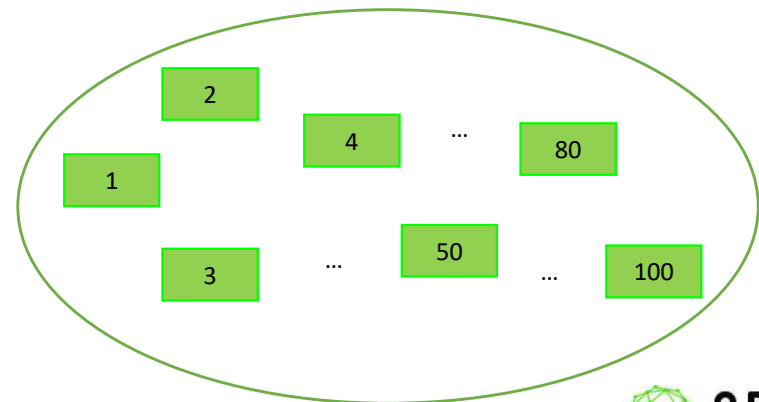
## Sequential:



- Lacks the capability to account for the needs of the upcoming inmates
- Fails to properly allocate resources to the inmates,
- Often leads to either overused or underutilized resources of the department,
- Is highly dependent on the order in which inmates are assigned to the facilities,
- Subjective, depends on expertise of staff,
- Is not fair for the inmates.

## Simultaneous:

- Takes into account:
  - The needs of all the inmates who need assignment
  - The resources that are available at the facilities
- Optimizes the assignment and resource allocations across the board.



# Inmate Assignment

- Optimize the initial assignment of inmates to facilities and inmate transfers between facilities
- Incorporating all the rules and criteria of the assignment:
  - General assignment factors:
    - Sentence information
    - Custody level
    - Mental and medical information
    - Rehabilitative programs
  - Treatment programs
  - Bed availability
  - Distance to home
  - Separations and STG information
- Goals:
  - Minimize the violation of the assignment rules
  - Minimize program waiting times and waiting lists
  - Balance the inmate population across the board
  - Reduce future inmate transportation
  - Reduce inmate population

# Inmate assignment criteria: General assignment factors

## General assignment factors:

Various factors (60+) affect the assignment, including but not limited to:

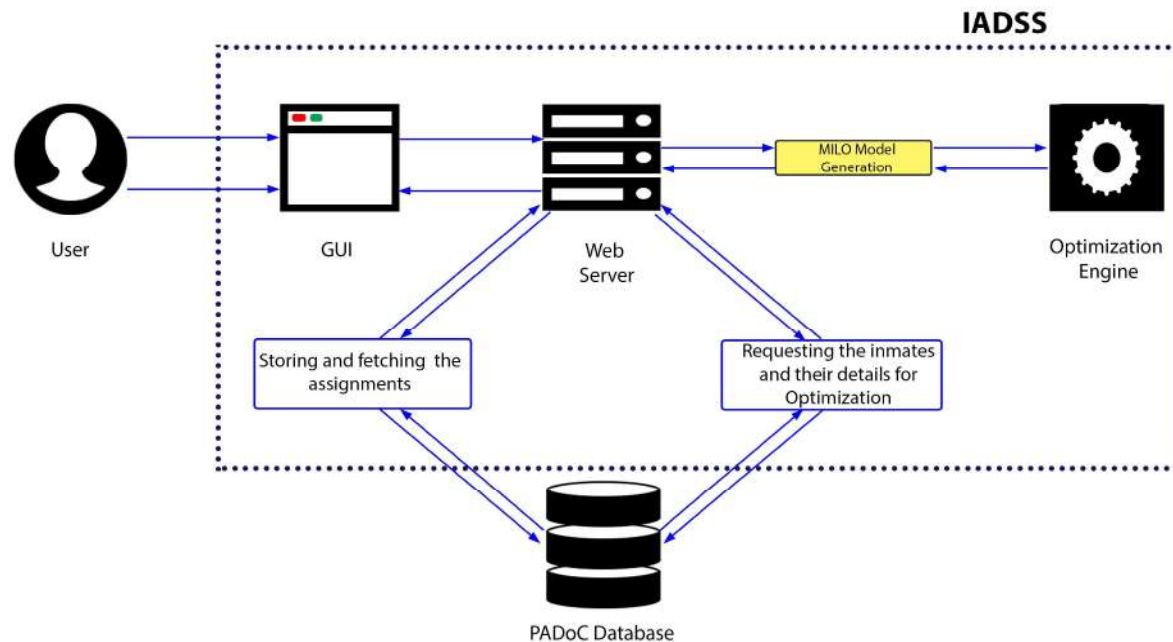
- Custody level
- Physical and mental health
- Escape attempt(s)
- Type of the crime
- Treatment program
- Age

Factor	Priority	ALB	BEN	CAM	CHS	COA	DAL	FRA	FRS	FYT	LAU	MAH	MER	PHX	PNG	QUE	RET	SMI
Therapeutic Community (TC)	High	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓
<18 mo. to release	Medium	✗	!	!	✓	!	!	✗	!	!	✓	!	!	!	!	✗	✗	!
Mental health issues	High	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✗	✗	✓	✗

# IADSS development

IADSS is comprised of

- The user-friendly integrated **web-based interface**
- The **optimization module**
  - heart of the IADSS
  - generates and solves the mathematical optimization model



# Optamo engagement with the PADOCC

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- The Optamo team has been engaged with the PADOCC for 10 years.
- Developed the Inmate Assignment Decision Support System (IADSS).
- IADSS Used for daily assignment of inmates since [Sep. 2016](#).

Video Clip:

The Benefits and Impact of Optimizing Inmate Assignments at the PADOCC

<https://youtu.be/2jFWWh1Obxro>



 **ISE** Industrial and Systems Engineering



# Benefits and Impact at the PADOC

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## **Programming waiting time**

Decreased 54 days for inmates with < 9 months to their min date  
40 % reduction in program waiting times

## **Fewer transfers**

4,672 fewer transfers were needed in 2017  
35% reduction in inmate transportation

## **Fewer assaults**

Resulted in 20 fewer assaults in 2017

## **Reduced staff**

Less staff-hours needed for processing inmate assignment requests

# Benefits and impact at the Pennsylvania DOC

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- Used for daily assignment of inmates since **Sep. 2016**
- More than **40,000** inmates assigned to the facilities by the system.
- **96%** acceptance rate

# Quantified savings at the PADOCC

Item	First Year savings	Overall 5 year savings
Reduced waiting time	\$1,036,800.00	\$9,590,400.00
Fewer assaults	\$1,400,000.00	\$7,000,000.00
Fewer transfers	\$387,075.00	\$1,935,375.00
Reduced staff-hours	\$134,742.00	\$673,710.00
<b>Overall quantified savings</b>	<b>\$2,958,617.00</b>	<b>\$19,199,485.00</b>



Specialized Housing



Facility Assignment

## Georgia Department of Corrections (GDC): Benefits & Impact

# Specialized Housing Module

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Specialized  
Housing

On a daily basis providing the list of:

- **Eligible inmates** for specialized housing units
- **Necessary removals** from specialized housing units

# Specialized Housing Module



## Inmate Assignment Decision Support System

### Specialized Housing Module

[Back](#)

[Documentation](#)

#### Select Transfer Request Purpose

##### Eligibility

- County Camp
- Work Release
- Firefighter
- Governor's Mansion
- Metro Reentry
- Long Term Maintenance
- Evidence Based Programming
- Outside Details
- RSAT
- Burruss Kitchen Detail
- Burruss Guide Dog Program
- Macon TC Automotive Service Excellence
- Braille Program at Central SP
- Vocational Programs, OJT, Welding, CDL, Diesel Mechanics
- Annex
- Limited Supervision Outside Detail
- Sex Offender Release

##### Removal

- County Camp Removal
- Work Release Removal
- Long Term Maintenance Removal
- RSAT Removal

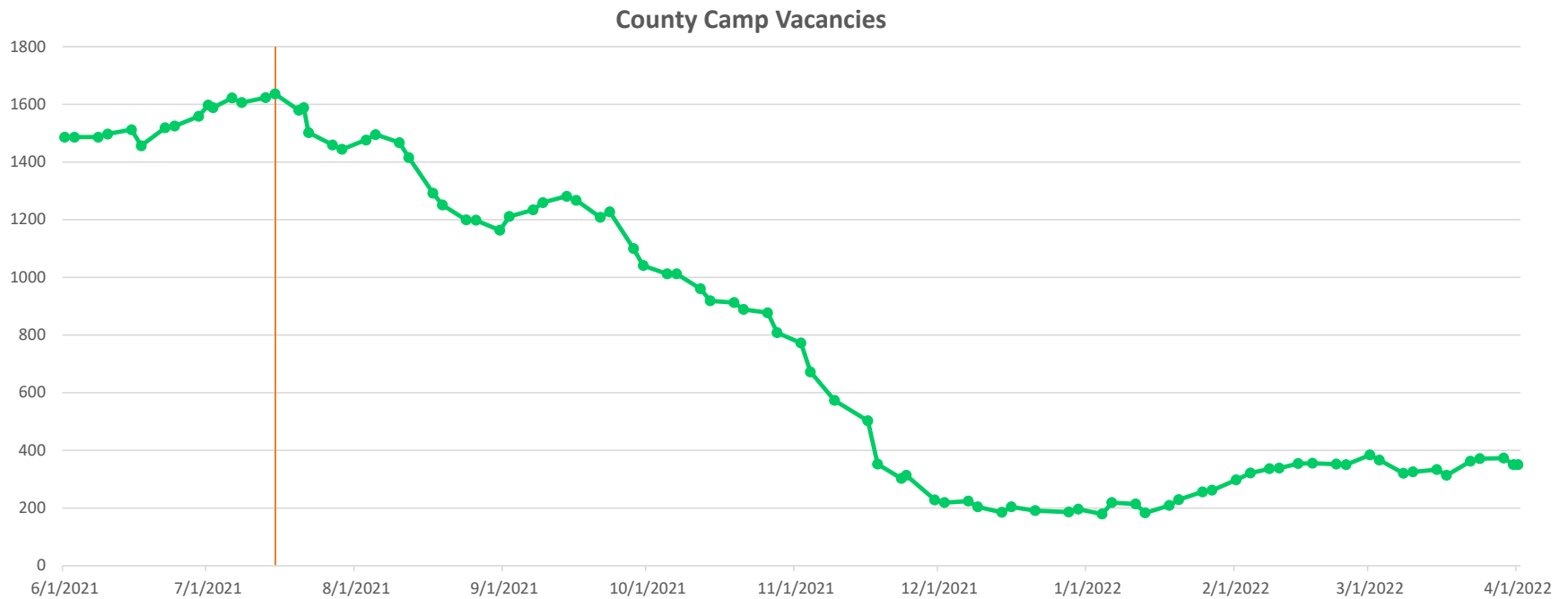
[Find Inmates](#)

# Eligibility and Assignment Criteria

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- Mapping out the
  - Eligibility criteria for 17 specialized housing units
  - The assignment criteria for ~20 transfer request types
- Refinement and Adjustment of eligibility and assignment criteria
- Access to the most update eligibility and assignment criteria
- Reducing Error-Prone Decision Making

# GDC: Minimizing County Camp Vacancies



# GDC: Minimizing County Camp Vacancies

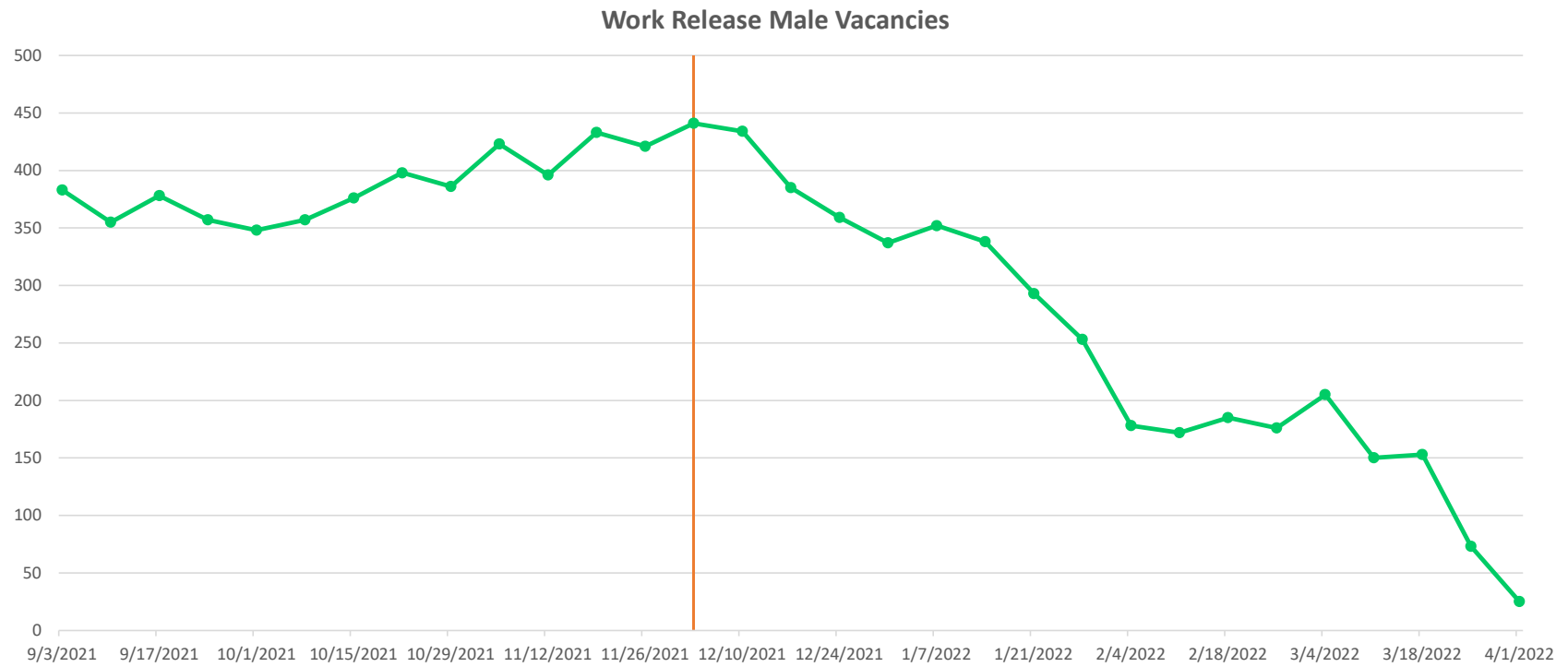
- County Camps vacancies reduced by **~86% in 4.5 months** (from 1636 on July 15<sup>th</sup> to 228 on Nov. 30<sup>th</sup>).
- FY2018 daily housing costs per inmate:
  - County Camp: \$20.00,
  - State Prison: \$65.95,
  - Difference of \$45.95.
- The vacancy has consistently been under 400 in the first quarter of 2022.

- **Annual Savings:**

$$(1,600-400) * \$45.95 \text{ (cost per day)} * 365 \text{ (days)} =$$

**\$20,126,100.00**

# GDC: Reducing Work Release Vacancies



# GDC: Reducing Work Release Vacancies

- Work Release vacancies reduced in **4 months** from 441 on Dec 3<sup>rd</sup>, 2021 to 25 on April 1<sup>st</sup>, 2022).
- FY2018 daily housing costs per inmate:
  - Work Release: \$45.11,
  - State prison: \$65.95,
  - Difference of \$20.84.

- **Annual Savings:**

$$(441-25) * \$20.84 \text{ (cost per day)} * 365 \text{ (days)} =$$

**\$3,164,345.60**

# Specialized Housing Module

## Data Analysis:

- # Unique criterion/rule checked for each inmate on a daily basis: ~250
- # Total criterion/rule checked for the entire population
  - Daily: 11,625,000
  - Monthly : 348,750,000

## If Done Manually:

- Assumption: Takes 10 seconds to manually check one criterion/rule.
- One analyst can review  $6 * 60 * 8 = 2,880$  criterion/rule per day
- # analysts needed:
  - Checking the entire population once a year: 11 analysts.
  - Checking the entire population daily: 4,036 analysts.

# Assignment Criteria: Assignment Factors

- Overall, **241** assignment factors identified so far:
- Three main categories:
  - **General Assignment Factors:** **47** factors identified so far:
    - Gender
    - Security level
    - STG
    - Sex Offender
    - SOR
    - SB-441
    - Life with/without parole
    - Etc.
  - **Profiles:** **191** profiles that impact inmate assignments
    - Mental Health: MH-2, MH-3, MH-4, MH-5
    - Medical Profiles: C-PAP, Wheelchair, Walker, O2 Concentrator, etc.
    - Etc.
  - **Activities:** **3** activities
    - Charter School
    - Special Edu
    - Veterans Reentry Program

# Reduced Firefighters Vacancies

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- # of Firefighter assignments:
  - 2020: 40 inmates (~3 inmates/month)
  - 2021 Q2-4: 79 inmates (~13 inmates/month)
  - 2022 Q1: 32 inmates (~10 inmates/month)
- 3-4 times more inmates were sent in 2021 and 2022 compared to 2020.

## Reducing the staff-hours to review transfer requests

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- Prior to Optamo, 7 analysts reviewed and assigned inmates out of the GDCP.
- Since the implementation of the assignment module, one analyst can review and schedule over 150 inmates out of the GDCP in one day.

# Swaps

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- Moving inmates between facilities without taking extra beds
- Currently, ~2500 pending transfer requests
- Not enough vacant beds to move these inmates
- Before swaps, ~140 moves per transfer day
- With swaps, >300 moves per transfer day

# Movements

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- Population Redistribution queue was implemented during phase II to assist with moving inmates for facility closure as well as for construction purposes
  - **Closure of GSP**
    - ~400 inmates were moved out of GSP using IADSS recommendations
  - **Baldwin**

# Removal Flags

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- Timely removal of inmates from:
  - County Camps
  - Work Release
  - Long Term Maintenance
  - RSAT
- Assisting with the security of the facilities
- Potentially helping to reduce escapes

# IADSS Critical Unique Features

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1. **Simultaneous** and optimal assignment of inmates to facilities
2. Capability to **fully customize** for the inmate assignments at the Nevada DOC
3. Incorporating **all** the business **rules**, policy **regulations** of the assignments
4. Incorporating **all** the **objectives** of the inmate assignments at the Nevada DOC
5. Advanced analytics and **mathematical optimization** engine
6. **Successful implementation** at the PADOC and the GDC
7. Simultaneous optimal assignment **within a few minutes**

# Questions

# Modules

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- **Facility Assignment:**

Optimizing the assignment of inmates to:

- Facilities
- Housing units

- **Specialized Housing Eligibility:**

Providing the daily list of the eligible inmates for the specialized housing units.

- **Transportation:**

Optimizing the inmate transportation planning

- **Detailed Program Scheduling:**

Optimizing the detailed scheduling of the programs at the facilities

# OPTAMO's development phases

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1. Study & Formalize
2. Customize & Implement
3. Test & Fine-tune
4. Support & Enhancement

# Inmate assignment criteria: available beds

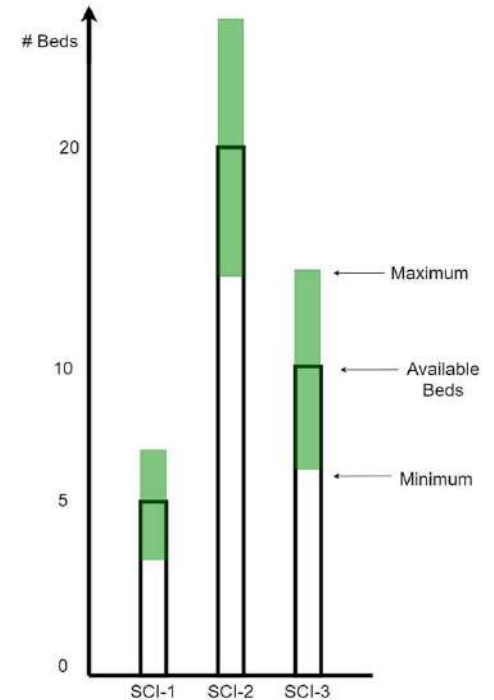
## Facility available beds

### Regular:

- Available beds of the facilities determined prior to assignment
- Operational capacity of facilities: required **minimum**, and allowed **maximum** fill given
- Assignment should be **proportional to the available beds**
- Goal: To prevent overcrowded and facilities

### Swaps:

- No extra beds are taken.
- Not only one-on-one swap



# Inmate assignment criteria: treatment programs

Prescribed treatment programs are part of rehabilitation

Need to finish programs **4 months** before min. sentence date

Can not go on parole unless completing all required programs

Waiting lists of programs due to limited resources

## Goals:

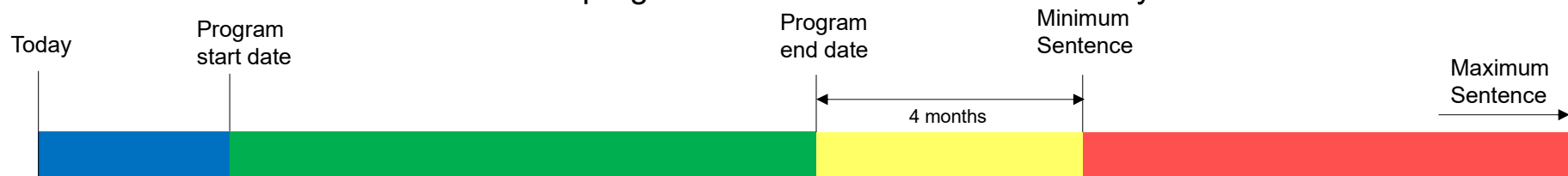
Enroll inmates in programs as soon as possible:

Minimize the waiting time for each inmate

Minimize the waiting list of the programs at the SCIs

We consider:

limited available resources for programs and inmates that are already in SCIs



# Treatment programs (Contd.)

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Programs classified into open enrollment or closed enrollment

## **Open enrollment programs:**

- Inmates may enroll at any time provided a spot is available

## **Closed enrollment programs:**

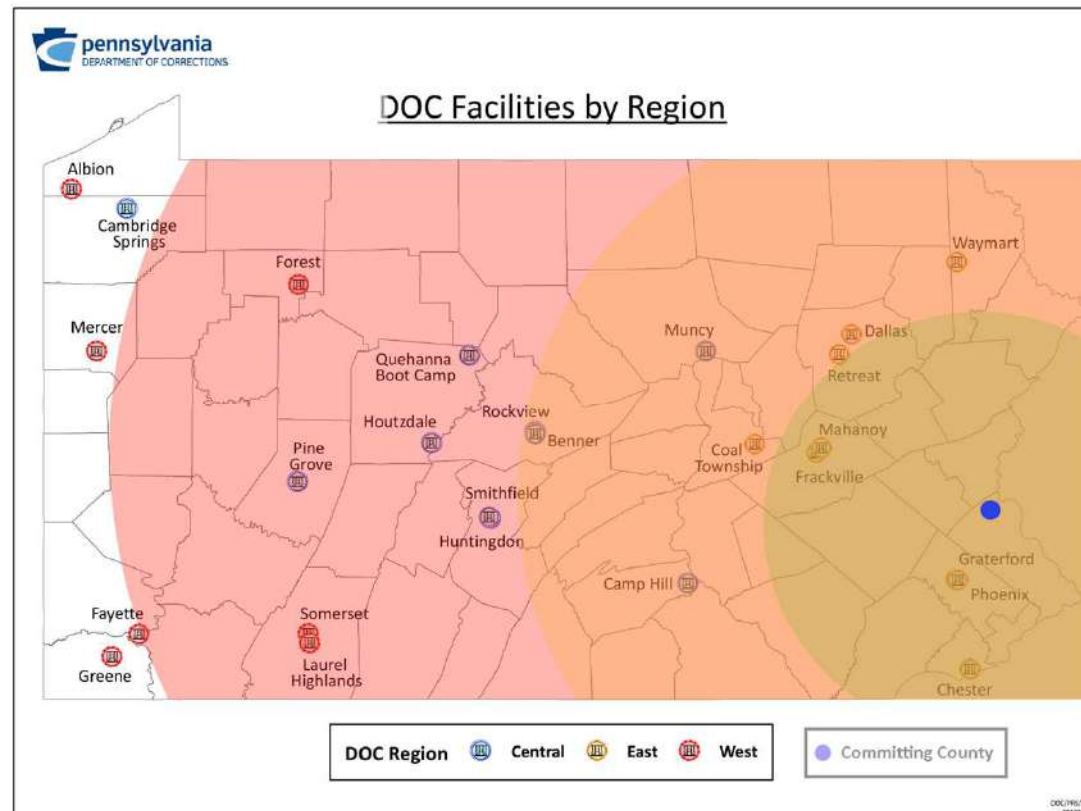
- A group of inmates is identified for a program
- All the inmates in a group start the program at the same time
- *Cluster*: Closed-enrollment programs with common instructor

# Inmate assignment criteria: distance to home

## Home County

Inmates should be assigned to a SCI near their home

Helps with family visits



# The Objectives

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## Hierarchically weighted objective

1. Violation of the general assignment factors
2. Minimizing maximum waiting time for each inmate
3. Minimizing the program waiting lists
4. Assigning in the range of min and max capacity of SCIs
5. Assigning to SCIs proportional to their functional capacity
6. Assigning inmates to a SCI near their home