美赛C题特点与切入

《美国数学建模竞赛》

完整课程请长按下方二维码

2016 MCM C: The Goodgrant Challenge

2016 MCM C: The Goodgrant Challenge

- The Goodgrant Foundation is a charitable organization that wants to help improve educational performance of undergraduates attending colleges and universities in the United States. To do this, the foundation intends to donate a total of $100,000,000 (US100 million) to an appropriate group of schools per year, for five years, starting July 2016. In doing so, they do not want to duplicate the investments and focus of other large grant organizations such as the Gates Foundation and Lumina Foundation.
- 该Goodgrant基金会就是要帮助提高本科生参加在美国学院和大学教育表现的慈善组织。为此，该基金会计划从2016年7月开始，连续5年，每年向适当的学校捐赠1亿美元。在这样做的时候，他们不希望重复其他大型赠款组织的投资和重点，如盖茨基金会和卢米娜基金会。

2016 MCM C: The Goodgrant Challenge

- Your team has been asked by the Goodgrant Foundation to develop a model to determine an optimal investment strategy that identifies the schools, the investment amount per school, the return on that investment, and the time duration that the organization's money should be provided to have the highest likelihood of producing a strong positive effect on student performance.
- Goodgrant基金会要求你的团队来开发一个模型来确定一个最优投资策略，并确定学校，每个学校的投资额，投资的回报，组织的资金应该提供的时间长度，对学生的表现产生强烈的积极影响的可能性是最大的。

2016 MCM C: The Goodgrant Challenge

- This strategy should contain a 1 to N optimized and prioritized candidate list of schools you are recommending for investment based on each candidate school's demonstrated potential for effective use of private funding, and an estimated return on investment (ROI) defined in a manner appropriate for a charitable organization such as the Goodgrant Foundation.
- 这个策略应该包含1到N最优候选学校的名单，你推荐的投资是基于每个候选人学校展示了潜在的私人资金的有效使用，估计投资回报(ROI)定义的方式适合Goodgrant基金会等慈善组织。

2016 MCM C: The Goodgrant Challenge

- To assist your effort, the attached data file (**ProblemCDATA.zip**) contains information extracted from the U.S. National Center on Education Statistics(www.nces.ed.gov/ipeds), which maintains an extensive database of survey information on nearly all post-secondary colleges and universities in the United States, and the College Scorecard data set (https://collegescorecard.ed.gov) which contains various institutional performance data. Your model and subsequent strategy must be based on some meaningful and defendable subset of these two data sets.
- 协助你的努力,附加的数据文件(ProblemCDATA.zip)包含信息从美国国家教育统计中心(www.nces.ed.gov /爱浦多)，是一个数据库，它的调查信息几乎包含美国所有专业学院和大学，大学计分卡的所有数据(https://collegescorecard.ed.gov),包含各种数据。您的模型和随后的策略必须基于这两个数据中的一些有意义和可证明的数据集。

2016 MCM C: The Goodgrant Challenge

In addition to the required one-page summary for your MCM submission, your report must include a letter to the Chief Financial Officer (CFO) of the Goodgrant Foundation, Mr. Alpha Chiang, that describes the optimal investment strategy, your modeling approach and major results, and a brief discussion of your proposed concept of a return-on-investment (ROI) that the Goodgrant Foundation should adopt for assessing the 2016 donation(s) and future philanthropic educational investments within the United States. This letter should be no more than two pages in length.

除了提交MCM所需的一页摘要外，您的报告还必须包括一封写给Goodgrant基金会首席财务官(CFO)的信，信中描述了最佳投资策略、您的建模方法和主要结果，并简要讨论您提出的投资回报率(ROI)概念，Goodgrant基金会应采用该概念评估2016年的捐款和美国境内未来的慈善教育投资。这封信的长度不应超过两页。

2016 MCM C: The Goodgrant Challenge

- Note: When submitting your final electronic solution **DO NOT** include any database files. The only thing that should be submitted is your electronic (Word or PDF) solution.
- 注意:提交最终的电子解决方案时不要包含任何数据库文件。唯一需要提交的是您的电子解决方案(Word或PDF)。

2016 MCM C: The Goodgrant Challenge

- The ProblemC DATA.zip data file contains:
- Problem C - IPEDS UID for Potential Candidate Schools.xlsx
- Problem C - Most Recent Cohorts Data (Scorecard Elements).xlsx
- Problem C - CollegeScorecardDataDictionary-09-08-2015.xlsx
- IPEDS Variables for Data Selection.pdf
- You can download the data (ProblemCDATA.zip) on the following websites:
- ProblemC data .zip数据文件包含:
- Problem C —— IPEDS UID 为 Potential Candidate Schools.xlsx
- Problem C —— Most Recent Cohorts Data (Scorecard Elements).xlsx
- Problem C —— CollegeScorecardDataDictionary - 09 - 08 - 2015. xlsx
- IPEDS Variables 为 Data Selection.pdf
- 你可在以下网址下载有关数据(ProblemCDATA.zip):

2017 MCM C:Cooperate and navigate

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- Traffic capacity is limited in many regions of the United States due to the number of lanes of roads.For example, in the Greater Seattle area drivers experience long delays during peak traffic hours because the volume of traffic exceeds the designed capacity of the road networks. This is particularly pronounced on Interstates 5, 90, and 405, as well as State Route 520, the roads of particular interest for this problem.
- 由于道路车道的数量，美国许多地区的通行能力受到限制。例如，在大西雅图地区，由于行车流量超过设计的公路网的能力，司机有在交通高峰期长时间延误的经历。这种现象在州际公路5，90，405，以及520号公路表现得尤其明显，道路的行驶问题受到极大关注。

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- Self-driving, cooperating cars have been proposed as a solution to increase capacity of highways without increasing number of lanes or roads. The behavior of these cars interacting with the existing traffic flow and each other is not well understood at this point.
- 在不增加车道或道路数量的情况下，自动驾驶、协同驾驶汽车已被提出作为增加高速公路容量的解决方案。这些汽车与现有交通流相互作用的行为还没有得到很好的理解。

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- The Governor of the state of Washington has asked for analysis of the effects of allowing self-driving,cooperating cars on the roads listed above in Thurston, Pierce, King, and Snohomish counties. (See the provided map and Excel spreadsheet). In particular, how do the effects change as the percentage of self-driving cars increases from 10% to 50% to 90%? Do equilibria exist? Is there a tipping point where performance changes markedly? Under what conditions, if any, should lanes be dedicated to these cars? Does your analysis of your model suggest any other policy changes?
- 华盛顿州州长要求分析在Thurston, Pierce, King, and Snohomish 地区允许无人驾驶合作汽车在上述公路通行的影响。(见所提供的地图和Excel电子表格)。特别是,自动驾驶汽车的比例从10%增加到50%到90%对交通的影响怎如何变化？平衡存在吗?是否存在一个临界点,使效应变化明显？在什么情况下，如果有的话，应该为这些汽车开辟专用车道?你分析的模型能有其他政策变化的建议吗?

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- Your answer should include a model of the effects on traffic flow of the number of lanes, peak and/or average traffic volume, and percentage of vehicles using self-driving, cooperating systems. Your model should address cooperation between self-driving cars as well as the interaction between selfdriving and non-self-driving vehicles. Your model should then be applied to the data for the roads of interest, provided in the attached Excel spreadsheet.
- 你的答案应该包括一个关于车道数量、高峰期和/或平均交通量对交通流影响的模型，以及使用自动驾驶、协作系统的车辆比例。你的模型应该指出自动驾驶汽车之间的合作以及自动驾驶和非自动驾驶车辆之间的相互作用。你的模型应该被应用到道路同行的数据,提供在电子表格中。

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- Your MCM submission should consist of a 1 page Summary Sheet, a 1-2 page letter to the Governor's office, and your solution (not to exceed 20 pages) for a maximum of 23 pages. Note: The appendix and references do not count toward the 23 page limit.
- 你的MCM提交应该由一个1页汇总表,1 - 2页给州长办公室的信,你的解决方案(不超过20页)最多23页。注意:附录和引用不计入23页的限制中。

2017MCM PROBLEM C:Cooperate and navigate协同与导航

Some useful background information:

- **· On average, 8% of the daily traffic volume occurs during peak travel hours.**
- **· The nominal speed limit for all these roads is 60 miles per hour.**
- **· Mileposts are numbered from south to north, and west to east.**
- **· Lane widths are the standard 12 feet.**
- **· Highway 90 is classified as a state route until it intersects Interstate 5.**
- **· In case of any conflict between the data provided in this problem and any other source, use the data provided in this problem.**

一些有用的背景信息:

- **平均8%的每日交通量发生在高峰期。**
- **名义上所有这些道路限速在每小时60英里。**
- **里程碑编号从南到北,西向东。**
- **车道宽度是标准的12英尺。**
- **90号公路直到与5号州际公路相交的路段列为国家路线,。**
- **在这个问题和其他来源提供的数据有任何冲突的情况下,使用在这个问题提供的数据。**

2017MCM PROBLEM C:Cooperate and navigate协同与导航

- Definitions:定义:
- milepost: A marker on the road that measures distance in miles from either the start of the route or a state boundary.
- average daily traffic: The average number of cars per day driving on the road.
- interstate: A limited access highway, part of a national system.
- state route: A state highway that may or may not be limited access.
- route ID: The number of the highway.
- increasing direction: Northbound for N-S roads, Eastbound for E-W roads.
- decreasing direction: Southbound for N-S roads, Westbound for E-W roads.
- 里程碑:一个公路上的标志,度量距离开始的路线或状态边界的英里数。
- 平均每日交通:每天行驶在路上的平均汽车数量。
- 州际:限制进入公路、国家系统的一部分。
- 国家路线:国道,可能是也可能不是限制进入。
- 路线ID:公路的编号。
- 增加方向:N-S公路往北,E-W公路往东。
- 减少方向:N-S公路南行,E-W公路西行。

2018 MCM C:Energy Production 能源生产

2018 MCM Problem C: Energy Production 能源生产

- **Background:** Energy production and usage are a major portion of any economy. In the United States, many aspects of energy policy are decentralized to the state level. Additionally, the varying geographies and industries of different states affect energy usage and production. In 1970, 12 western states in the U.S. formed the Western Interstate Energy Compact (WIEC), whose mission focused on fostering cooperation between these states for the development and management of nuclear energy technologies. An interstate compact is a contractual arrangement made between two or more states in which these states agree on a specific policy issue and either adopt a set of standards or cooperate with one another on a particular regional or national matter.
- 背景：能源生产和使用是任何经济的主要部分。 在美国，能源政策的许多方面分散到州层面。此外，不同州的不同地区和行业也影响能源使用和生产。1970年，美国的 12个西方国家组建了西部州际能源契约（WIEC），其使命的重点是促进这些州之间的合作，以开发和管理核能技术。州际契约是两个或两个以上的州之间的合同安排，在这两个州之间，这些州就具体的政策问题达成一致，并采取一套标准或就某一地区或州事务相互合作。

2018 MCM Problem C: Energy Production 能源生产

- **Problem:** Along the U.S. border with Mexico, there are four states – California (CA), Arizona (AZ), New Mexico (NM), and Texas (TX) – that wish to form a realistic new energy compact focused on increased usage of cleaner, renewable energy sources. Your team has been asked by the four governors of these states to perform data analysis and modeling to inform their development of a set of goals for their interstate energy compact.
- 问题：在美国与墨西哥的边界上，有四个州 – 加利福尼亚州（CA），亚利桑那州 （AZ），新墨西哥州（NM）和德克萨斯州（TX） –希望形成一个现实的新能源契约，专注于增加清洁、可再生能源的使用。您的团队已经被这些州的四位州长要求进行数据分析和建模，以便为他们的州际能源契约制定一套目标。

2018 MCM Problem C: Energy Production 能源生产

- The attached data file "ProblemCData.xlsx" provides in the first worksheet ("**seseds**") 50 years of data in 605 variables on each of these four states' energy production and consumption, along with some demographic and economic information. The 605 variable names used in this dataset are defined in the second worksheet ("**msncodes**").
- 附加的数据文件"ProblemCData.xlsx"在第一个工作表（"seseds"）中提供了这四个州的能源生产和消费中的605个变量的50年数据以及一些人口和经济信息。在这个数据集中使用的605个变量名在第二个工作表（"msncodes"）中定义。

2018 MCM Problem C: Energy Production 能源生产

- **Part I:**
- **A.** Using the data provided, create an energy profile for each of the four states.
- **第一部分：**
- **A.** 使用提供的数据，为每一个州创建一个能源配置文件。

2018 MCM Problem C: Energy Production 能源生产

- **B.** Develop a model to characterize how the energy profile of each of the four states has evolved from 1960 – 2009. Analyze and interpret the results of your model to address the four states' usage of cleaner, renewable energy sources in a way that is easily understood by the governors and helps them to understand the similarities and difference between the four states. Include in your discussion possible influential factors of the similarities and differences (e.g. geography, industry, population, and climate).
- **B.** 开发一个模型来描述1960年至2009年四个州中每个州的能源状况是如何演变的。分析和解释你的模型的结果，以一种容易被州长理解的方式来处理这四个州对清洁、可再生能源的使用，并帮助他们理解这四个州之间的异同。在你的讨论中加入可能影响相同和不同点的因素（如地理，行业，人口和气候）。

2018 MCM Problem C: Energy Production 能源生产

- **C.** Determine which of the four states appeared to have the “best” profile for use of cleaner, renewable energy in 2009. Explain your criteria and choice.
- **D.** Based on the historical evolution of energy use in these states, and your understanding of the differences between the state profiles you established, predict the energy profile of each state, as you have defined it, for 2025 and 2050 in the absence of any policy changes by each governor’s office.
- C. 确定2009年四个州中哪些州似乎具有“最好”的使用清洁可再生能源的概况。解释你的标准和选择。
- D. 根据这些州能源使用的历史演变，以及您对所建立的国家概况之间的差异的理解，按照您的定义，预测2025年和2050年每个州在没有由每个州长办公室的政策变化的情况下的能源概况。

2018 MCM Problem C: Energy Production 能源生产

- **Part II:**
- **A.** Based on your comparison between the four states, your criteria for "best" profile, and your predictions, determine renewable energy usage targets for 2025 and 2050 and state them as goals for this new four-state energy compact.
- **B.** Identify and discuss at least three actions the four states might take to meet their energy compact goals.
- **第二部分：**
- **A.** 根据对四个州之间的比较，你们对"最佳"概况和你们预测的标准决定了2025年和2050年的可再生能源使用目标，并将它们作为这个新的四国能源契约的目标。
- **B.** 确定并讨论四个州为实现能源紧凑目标可能采取的至少三项行动。

2018 MCM Problem C: Energy Production 能源生产

- **Part III:**
- Prepare a one-page memo to the group of Governors summarizing the state profiles as of 2009, your predictions with regard to energy usage absent any policy changes, and your recommended goals for the energy compact to adopt.
- **第三部分：**
- 为州长们准备一份一页的备忘录，概述2009年的各州概况，你对能源使用的预测没有任何变化，以及采用你对能源契约的建议。

2018 MCM Problem C: Energy Production 能源生产

- Your submission should consist of:
- One-page Summary Sheet,
- One-page memo,
- Your solution of no more than 20 pages, for a maximum of 22 pages with your summary
- and memo.
- Note: Reference list and any appendices do not count toward the 22-page limit and should appear after your completed solution.
- 您的提交应该包括：
- 一页总结表，
- 单页备忘录，
- 您的解决方案不超过20页，最多22页的摘要和备忘录。
- 注意：参考列表和任何附录不计入22页的限制，应在完成的解决方案后出现

2018 MCM Problem C: Energy Production 能源生产

- **Attachments:**
- ProblemCData.xlsx
- Includes two worksheets **seseds** and **msncodes**.
- **References:**
- State Energy Data System (SEDS) Complete Dataset through 2009 (All 50 states)
- https://catalog.data.gov/dataset/state-energy-data-system-seds-complete-dataset-through-2009#sec-dates
- **附件：**
- ProblemCData.xlsx
- 包括seseds和msncodes两个工作表。
- **参考文献：**
- 国家能源数据系统（SEDS）到2009年全部数据集（全部50个州）
- https://catalog.data.gov/dataset/state-energy-data-system-seds-complete-dataset-through-2009年＃仲日期

2019 MCM C:The Opioid Crisis 阿片类药物危机

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Background:** The United States is experiencing a national crisis regarding the use of *synthetic* and *non synthetic opioids*, either for the treatment and management of pain (legal, prescription use) or for recreational purposes (illegal, non-prescription use). Federal organizations such as the Centers for Disease Control (CDC) are struggling to "save lives and prevent negative health effects of this epidemic, such as opioid use disorder, hepatitis, and HIV infections, and neonatal abstinence syndrome."**1** Simply enforcing existing laws is a complex challenge for the Federal Bureau of Investigation (FBI), and the U.S. Drug Enforcement Administration (DEA), among others.
- 背景：美国正在经历关于使用合成和非合成阿片类药物的国家危机，无论是治疗和管理疼痛（法律，处方用途）还是用于娱乐目的（非法，非处方用途）。美国疾病控制中心（CDC）等联邦组织 正在努力“拯救生命并预防这种流行病对健康的负面影响，如阿片类药物使用障碍，肝炎和艾滋 病毒感染以及新生儿戒断综合症。”[1] 对联邦调查局（FBI）和美国缉毒局（DEA）等只是强制执行现行法律都是一项复杂的挑战。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- There are implications for important sectors of the U.S. economy as well. For example, if the opioid crisis spreads to all cross-sections of the U.S. population (including the college-educated and those with advanced degrees), businesses requiring precision labor skills, high technology component assembly, and sensitive trust or security relationships with clients and customers might have difficulty filling these positions. Further, if the percentage of people with opioid addiction increases within the elderly, health care costs and assisted living facility staffing will also be affected.
- 这对美国经济的重要部门也有影响。例如，如果阿片类药物危机蔓延到美国人口的所有阶层(包括受过大学教育的人和拥有高等学位的人)，那些需要精密劳动技能、高技术组件组装以及与客户和客户之间敏感的信任或安全关系的企业可能难以填补这些职位空缺。此外，如果老年人中阿片类药物成瘾的比例增加，医疗保健费用和辅助生活设施的人员配置也将受到影响。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- The DEA/National Forensic Laboratory Information System (NFLIS), as part of the Drug Enforcement Administration's (DEA) Office of Diversion Control, publishes a data-heavy annual report addressing "drug identification results and associated information from drug cases analyzed by federal, state, and local forensic laboratories." The database within NFLIS includes data from crime laboratories that handle over 88% of the nation's estimated 1.2 million annual state and local drug cases. For this problem, we focus on the individual counties located in five (5) U.S. states: Ohio, Kentucky, West Virginia, Virginia, and Tennessee. In the U.S., a *county* is the next lower level of government below each state that has taxation authority.
- DEA/国家法医实验室信息系统(NFLIS)是美国缉毒局(DEA)毒品转移控制办公室的一部分，它发布一份数据量很大的年度报告，其中涉及“联邦、州和地方法医实验室分析的毒品案件的药物鉴定结果和相关信息”。NFLIS的数据库包括来自犯罪实验室的数据，这些数据处理了全国估计120万州和地方毒品案件中的88%。对于这个问题，我们主要关注位于美国五个州的各个县:俄亥俄州、肯塔基州、西弗吉尼亚州、弗吉尼亚州和田纳西州。在美国在美国，县是在每个有税务机关的州之下的下一级政府。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- Supplied with this problem description are several data sets for your use. The first file (MCM_NFLIS_Data.xlsx) contains drug identification counts in years 2010-2017 for narcotic analgesics (synthetic opioids) and *heroin* in each of the counties from these five states as reported to the DEA by crime laboratories throughout each state. A drug identification occurs when evidence is submitted to crime laboratories by law enforcement agencies as part of a criminal investigation and the laboratory's forensic scientists test the evidence. Typically, when law enforcement organizations submit these samples, they provide location data (county) with their incident reports. When evidence is submitted to a crime laboratory and this location data is not provided, the crime laboratory uses the location of the city/county/state investigating law enforcement organization that submitted the case. For the purposes of this problem, you may assume that the county location data are correct as provided.
- 提供此问题描述的是几个供您使用的数据集。第一份文件（MCM_NFLIS_Data.xlsx）包含2010- 2017年麻醉镇痛药（合成阿片类药物）和海洛因的药物鉴定计数，这些药物来自这五个州的每个县，由各州的犯罪实验室向DEA报告。当执法机构将证据作为刑事调查的一部分提交给犯罪实验室，实验室的法医学家对证据进行检验时，就会进行药物鉴定。通常，当执法机构提交这些样本时，他们会提供位置数据（县）及其事故报告。当证据提交给犯罪实验室并且未提供此位置数据时，犯罪实验室使用提交案件的市/县/州调查执法组织的位置。为了解决这个问题，您可以假设县位置数据是正确的。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- The additional seven (7) files are zipped folders containing extracts from the U.S. Census Bureau that represent a common set of *socio-economic factors* collected for the counties of these five states during each of the years 2010-2016 (ACS_xx_5YR_DP02.zip). (Note: The same data were not available for 2017.)
- 另外七个文件是压缩文件夹，其中包含美国人口普查局的摘录，这些摘录代表了2010- 2016每年中为这五个州的县收集的一组共同的社会经济因素（ACS_xx_5YR_DP02.zip）。（注：2017年没有相同的数据。）

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- A code sheet is present with each data set that defines each of the variables noted. While you may use other resources for research and background information, THE DATA SETS PROVIDED CONTAIN THE ONLY DATA YOU SHOULD USE FOR THIS PROBLEM.
- Centers for Disease Control website, (https://www.cdc.gov/features/confronting-opioids/index.html), accessed 4 September 2018.
- 每个数据集都有一个代码表，用于定义所记录的每个变量。虽然您可以使用其他资源进行研究和背景信息，但提供的数据集包含您应该使用的唯一数据来解决此问题。
- 1疾病控制中心网站，（https://www.cdc.gov/features/confronting-opioids/index.html ），2018年9月4日访问。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Problem:**
- **Part 1.** Using the NFLIS data provided, build a mathematical model to describe the spread and characteristics of the reported synthetic opioid and heroin incidents (cases) in and between the five states and their counties over time. Using your model, identify any possible locations where specific opioid use might have started in each of the five states.
- **问题：**
- 第1部分。利用NFLIS提供的数据，建立一个数学模型来描述报告的合成阿片和海洛因事件(案例)在这五个州及其县之间随时间的传播和特征。使用您的模型，确定在五个州中每个州可能已开始使用特定阿片类药物的任何可能位置。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- If the patterns and characteristics your team identified continue, are there any specific concerns the U.S. government should have? At what drug identification threshold levels do these occur? Where and when does your model predict they will occur in the future?
- 如果您的团队确定的模式和特征继续存在，美国政府应该有任何具体问题吗？在这些药物识别阈值水平发生这些情况？你的模型预测它们将在何时何地发生？

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Part 2.** Using the U.S. Census socio-economic data provided, address the following questions:
- There are a good number of competing hypotheses that have been offered as explanations as to how opioid use got to its current level, who is using/abusing it, what contributes to the growth in opioid use and addiction, and why opioid use persists despite its known dangers. Is use or trends-in-use somehow associated with any of the U.S. Census socio-economic data provided? If so, modify your model from **Part 1** to include any important factors from this data set.
- 第2部分。使用美国人口普查提供的社会经济数据，解决以下问题：
- 有许多相互矛盾的假设被提供作为阿片类药物使用如何达到目前水平的解释，使用/滥用阿片类药物，什么原因促使阿使用。片类药物使用和成瘾增长，以及为什么仍然存在已知的危险下阿片类药物的还在使用。使用或势是否与某些美国人口普查提供的社会经济数据有关？如果是这样，请从第1部分修改模型以包含此数据集中的任何重要因素。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Part 3.** Finally, using a combination of your **Part 1** and **Part 2** results, identify a possible strategy for countering the opioid crisis. Use your model(s) to test the effectiveness of this strategy; identifying any significant parameter bounds that success (or failure) is dependent upon. In addition to your main report, include a 1-2 page memo to the Chief Administrator, DEA/NFLIS Database summarizing any significant insights or results you identified during this modeling effort.
- 第3部分。最后，结合第1部分和第2部分的结果，确定应对阿片类药物危机的可能策略。使用你的模型来测试这个策略的有效性;确定成功(或失败)所依赖的任何重要参数界限。除了你的主要报告外，还要包括一份1-2页的备忘录给首席管理员，DEA/NFLIS数据库总结你在建模过程中发现的任何重要的见解或结果。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- Your submission should consist of:
- One-page Summary Sheet,
- One- to Two-page memo,
- Your solution of no more than 20 pages, for a maximum of 23 pages with your summary and memo.
- Note: Reference list and any appendices do not count toward the 23-page limit and should appear after your completed solution.
- 您的提交应包括：
- 一页摘要表，
- 一到两页的备忘录，
- 您的解决方案不超过20页，最多23页，包括您的摘要和备忘录。
- 注意：参考列表和任何附录不计入23页的限制，应在完成的解决方案后显示。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Attachments:**
- 2019_MCMProblemC_DATA.zip - Includes seven zip folders and the NFLIS_Data file.
- ACS_10_5YR_DP02.zip
- ACS_11_5YR_DP02.zip
- ACS_12_5YR_DP02.zip
- ACS_13_5YR_DP02.zip
- ACS_14_5YR_DP02.zip
- ACS_15_5YR_DP02.zip
- ACS_16_5YR_DP02.zip
- MCM_NFLIS_Data.xlsx

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **Glossary:**
- **analgesic –** pain relieving medication
- **county –** (in the U.S.) an administrative or political subdivision of a state; a region having specific boundaries and some level of governmental authority.
- **heroin –** an illegal, euphoria producing, highly addictive analgesic drug processed from morphine (a naturally occurring substance extracted from the seed pods of certain varieties of poppy plants).
- **名词解释：**
- **镇**痛药 – 缓解疼痛的药物
- **县** – （在美国）国家的行政或政治分支;具有特定边界和某种程度的政府权威的地区。
- **海**洛因 – 由吗啡（从某些罂粟植物的种子荚中提取的天然物质）加工而成的一 种非法的，产生欣快感的高度上瘾镇痛药。

2019 MCM Problem C: The Opioid Crisis 阿片类药物危机

- **non-synthetic opioids –** a class of drugs made from extracting chemicals in opium leaves, e.g. morphine, codeine, heroin.
- **opioids –** pain relieving drugs that are often highly addictive
- **socio-economic factors** – factors within a society that describe the relationship between social and economic status and class such as education, income, occupation, and employment.
- **synthetic opioid –** man-made opioids
- **非**合成阿片类药物 – 一种由鸦片叶中提取化学物质制成的药物，如吗啡，可待因，海洛因。
- **阿**片类药物 – 缓解药物往往很容易上瘾
- **社**会经济因素 – 社会中描述社会和经济地位与阶级之间关系的因素，如教育，收入，职业和就业。
- **合成阿片类药物 – 人造阿片类药物**