

2023 MidMCM

Problem C: Preparing for Olympic Medal Ceremonies

Note: Only teams with all members younger than 14 ½ years old may choose Problem C.



Photo Credit: Pixabay.com

The next Olympic Games are being hosted by Paris, France and will be held 26 July - 11 August 2024. The International Olympic Committee (IOC) wants to prepare by ordering enough medals and flags for the medal ceremonies. The IOC wants to make sure they have enough medals and flags for all the ceremonies to avoid being embarrassed. The IOC also does not want to waste money, however, by ordering too many medals and flags that will not be used. Therefore, the IOC has asked your team at MidMCM Olympic Consultants to provide models they can use to determine how many medals and flags they will need.

The research team at MidMCM Olympic Consultants has compiled the following information about the Paris 2024 Olympics to help you get started.

- **Participating Countries:** In total, invitations to the Paris 2024 Olympic Games have been sent to 203 eligible National Olympic Committees (NOCs) inviting their countries, regions, territories, or unaffiliated groups of athletes to compete. Therefore, there may be up to 203 delegations of athletes, each represented by their own unique flag, at the Paris 2024 Olympics.^[1]
- **Olympic Sports:** The summer Olympics for 2024 consists of 40 sports.^[2] Sports may consist of multiple events that each receive medals, so the Paris Olympics will have 329 medal events.^[3] The events may be individual and/or team events for a particular sport. Swimming, for example, has different individual events for each of the strokes (freestyle, butterfly, etc.) and different distances (100m, 200m, etc.), as well as relay events where a team of swimmers participate. Additionally, many sports have men's, women's, and mixed gender versions of the events.
- **Medal Ceremonies:** Each Olympic sporting event awards three levels of medals, Bronze for 3rd place, Silver for 2nd place, and Gold for 1st place. For each medal ceremony, medals are awarded to the individual athletes or to each individual member of a team. Additionally, the flag under which an individual or team is competing is flown above the podium stand for each individual or team winning any level medal.
- **Venues:** The Paris 2024 Olympics will be hosted at 37 venues where the Olympic sports will take place.^[4] Most of the venues are centered in and around Paris, but there are also venues spread across the country and even overseas to Tahiti.^[5]

While this research may get you started, your team will likely want to add to it. Doing your own research will help you to understand the situation more fully and to develop models that will be most helpful for the IOC.

Requirements

1. **Get Started.** Choose ONE of the following three venues.
 - Venues:
 - La Défense Arena (Swimming and Water Polo)
 - Bercy Arena (Gymnastics – Artistic and Trampoline – and Basketball)
 - Stade de France (Athletics and Rugby)
 - a. Develop a schedule of the medal ceremonies you would expect to happen at the venue you selected. In making your schedule you will likely need to make some *assumptions*.
 - b. Use your schedule and any other helpful information to create a model to determine how many of each type of medal (gold, silver, and bronze) your selected venue will need. In doing so, you may want to consider:
 - i. What is the minimum number of each kind of medal that venue could need?
 - ii. What is the maximum number of each kind of medal that venue could need?
 - iii. What is the best number of each kind of medal that venue should have?
 - c. Use your schedule and any other helpful information to create a model to determine what flags – and how many of each – your selected venue will need. In doing so, you may want to consider:
 - i. What flags could your selected venue possibly need?
 - ii. What is the minimum number of each kind of flag that venue could need?
 - iii. What is the maximum number of each kind of flag that venue could need?
 - iv. What flags should your selected venue have and what is the best number of each of those kinds of flags?
2. **Create your Model.** Apply your models to the other two venues listed above.
 - a. Use what you learn from applying your medal model to create a model for the medals needed for all three venues.
 - b. Use what you learn from applying your flag model to create a model for the flags needed for all three venues.
3. **Share your Model.** Create a one- to two-page letter to the IOC explaining how your model can determine an appropriate number of medals and flags for the Paris 2024 Olympic medal ceremonies. Explain how your model provides a reasonable answer that satisfies the IOC's need to avoid embarrassment and avoid wasting money.
4. **Reflect.** Can your model be used for the full schedule of Paris Summer 2024 Olympics at all 37 venues? Can your model be used by the IOC to know how many flags they will need for future Summer Olympics? Can your model be used by the IOC for the Winter Olympics so that they know how many flags they will need for Winter Olympics medal ceremonies? (You **do not** need to apply your model in any of these ways. Instead, you should think about the possibility of doing so and briefly describe whether you think it will work. Be sure to explain why you think what you do!)

Your MidMCM PDF solution document should include the following:

- a. One-page Summary Sheet.
- b. Table of Contents.
- c. Your complete solution to the problem and requirements. See MidMCM Guidance at the end of this document.
- d. One- to two-page letter to the IOC.
- e. References List (for example, any websites you used to gather information).
- f. [AI Use Report](#) (if used)

There is no specific required minimum page length for a complete MidMCM submission. You may use up to 25 total pages for all your solution work and any additional information you want to include (for example: drawings, diagrams, calculations, tables). Partial solutions are accepted. We permit the careful use of AI such as ChatGPT, although it is not necessary to create a solution to this problem. If you choose to utilize a generative AI, you must follow the [COMAP AI use policy](#). This will result in an additional AI use report that you must add to the end of your PDF solution file and does not count toward the 25 total page limit for your solution.

Glossary

Assumptions: hypotheses or educated guesses that take the place of an unknown or uncertain piece of information.

References

- [1] <https://olympics.com/ioc/news/one-year-to-go-ioc-invites-nocs-and-their-best-athletes-to-the-olympic-games-paris-2024>
- [2] <https://olympics.com/en/sports/summer-olympics#paris-2024>
- [3] <https://olympics.com/en/news/olympic-games-paris-2024-full-schedule-and-day-by-day-competitions>
- [4] <https://www.parisdigest.com/sports/paris-olympics-2024.htm#:~:text=Paris%20Olympics%20venue%20map%20locates,26%20to%20August%2011%202024>
- [5] <https://www.paris2024.org/en/competition-venue-concept/>

Guidance for MidMCM

COMAP has a Judges' Commentary article from the 2022 MidMCM contest available at https://www.contest.comap.com/highschool/contests/himcm/flyers/Cons_MidMCM.pdf. The commentary article provides guidance to both advisors and students. We also provide the following general guidance about MidMCM submission organization.

Solutions must be in PDF format and submitted in one PDF document. This does not preclude MidMCM teams from doing mathematics, graphs, tables, sketches, etc. by hand and including pictures of their work in the single PDF document submission. As students move to high school and the HiMCM, we expect that submissions will be typed. For the MidMCM, advisors may technically assist students in putting their solution components into one PDF format file for submission.

As with HiMCM, there is a 25-page limit for the submission document. This does not mean your solution must be 25 pages. A shorter submission is certainly acceptable. All portions of your submission (text, graphs, tables, charts, pictures, etc.) must be within **one** PDF document that is 25 pages or less. We accept partial solutions. Then, if you have utilized any artificial intelligence programs, such as ChatGPT, you will append an AI Use Report after your solution – that report does not count towards the 25 page cap on the solution portion of your PDF.

In general, a complete solution submission is organized as follows:

Executive Summary – Write this summary after you have done all your work. This one-page summary is Page #1 of your solution document. It provides an overview of your work and includes actual results.

Table of Contents – List the major items in your solution document to show the organization of your paper.

Introduction and Restatement of the Problem – Introduce the problem. Restate the problem and requirements in your own words.

Assumptions with Justifications – State any assumptions you made to simplify and solve the problem and state why you made those assumptions.

Variable Definitions – Define any variables you use in your model and equations.

Presentation of Model and Solution – Ensure you address all requirements and describe what you are doing in solving the problem. Show and explain all your work. Use representations that help you tell the reader how you solved the problem (for example: equations, tables, graphs, pictures, etc.).

Analysis of Your Work – Address any strengths (good points) and limitations (weaknesses) of your model and solution.

Concluding Paragraph – End your solution paper with a final concluding paragraph that summarizes your results and/or makes recommendations for future work.

Reference List – List any sources that you used to solve the problem (for example, website pages, newspaper or magazine articles, etc.).

AI Use Report – This only applies if you used generative AI systems such as ChatGPT. [Follow the guidance provided here](#). These additional pages do not count toward the 25 page limit for the rest of your submission.

Use of Large Language Models and Generative AI Tools in COMAP Contests

This policy is motivated by the rise of large language models (LLMs) and generative AI assisted technologies. The policy aims to provide greater transparency and guidance to teams, advisors, and judges. This policy applies to all aspects of student work, from research and development of models (including code creation) to the written report. Since these emerging technologies are quickly evolving, COMAP will refine this policy as appropriate.

Teams must be open and honest about all their uses of AI tools. The more transparent a team and its submission are, the more likely it is that their work can be fully trusted, appreciated, and correctly used by others. These disclosures aid in understanding the development of intellectual work and in the proper acknowledgement of contributions. Without open and clear citations and references of the role of AI tools, it is more likely that questionable passages and work could be identified as plagiarism and disqualified.

Solving the problems does not require the use of AI tools, although their responsible use is permitted. COMAP recognizes the value of LLMs and generative AI as productivity tools that can help teams in preparing their submission; to generate initial ideas for a structure, for example, or when summarizing, paraphrasing, language polishing etc. There are many tasks in model development where human creativity and teamwork is essential, and where a reliance on AI tools introduces risks. Therefore, we advise caution when using these technologies for tasks such as model selection and building, assisting in the creation of code, interpreting data and results of models, and drawing scientific conclusions.

It is important to note that LLMs and generative AI have limitations and are unable to replace human creativity and critical thinking. COMAP advises teams to be aware of these risks if they choose to use LLMs:

- **Objectivity:** Previously published content containing racist, sexist, or other biases can arise in LLM-generated text, and some important viewpoints may not be represented.
- **Accuracy:** LLMs can ‘hallucinate’ i.e. generate false content, especially when used outside of their domain or when dealing with complex or ambiguous topics. They can generate content that is linguistically but not scientifically plausible, they can get facts wrong, and they have been shown to generate citations that don’t exist. Some LLMs are only trained on content published before a particular date and therefore present an incomplete picture.
- **Contextual understanding:** LLMs cannot apply human understanding to the context of a piece of text, especially when dealing with idiomatic expressions, sarcasm, humor, or metaphorical language. This can lead to errors or misinterpretations in the generated content.
- **Training data:** LLMs require a large amount of high-quality training data to achieve optimal performance. In some domains or languages, however, such data may not be readily available, thus limiting the usefulness of any output.

Guidance for teams

Teams are required to:

1. **Clearly indicate the use of LLMs or other AI tools in their report**, including which model was used and for what purpose. Please use inline citations and the reference section. Also append the Report on Use of AI (described below) after your 25-page solution.
2. **Verify the accuracy, validity, and appropriateness** of the content and any citations generated by language models and correct any errors or inconsistencies.
3. **Provide citation and references, following guidance provided here.** Double-check citations to ensure they are accurate and are properly referenced.
4. **Be conscious of the potential for plagiarism** since LLMs may reproduce substantial text from other sources. Check the original sources to be sure you are not plagiarizing someone else's work.

**COMAP will take appropriate action
when we identify submissions likely prepared with
undisclosed use of such tools.**

Citation and Referencing Directions

Think carefully about how to document and reference whatever tools the team may choose to use. A variety of style guides are beginning to incorporate policies for the citation and referencing of AI tools. Use inline citations and list all AI tools used in the reference section of your 25-page solution.

Whether or not a team chooses to use AI tools, the main solution report is still limited to 25 pages. If a team chooses to utilize AI, following the end of your report, add a new section titled Report on Use of AI. This new section has no page limit and will not be counted as part of the 25-page solution.

Examples (this is *not* exhaustive – adapt these examples to your situation):

Report on Use of AI

1. OpenAI *ChatGPT* (Nov 5, 2023 version, ChatGPT-4.)
Query1: *<insert the exact wording you input into the AI tool>*
Output: *<insert the complete output from the AI tool>*
2. OpenAI *Ernie* (Nov 5, 2023 version, Ernie 4.0)
Query1: *<insert the exact wording of any subsequent input into the AI tool>*
Output: *<insert the complete output from the second query>*
3. Github *CoPilot* (Feb 3, 2024 version)
Query1: *<insert the exact wording you input into the AI tool>*
Output: *<insert the complete output from the AI tool>*
4. Google *Bard* (Feb 2, 2024 version)
Query: *<insert the exact wording of your query>*
Output: *<insert the complete output from the AI tool>*