**Motivation**

* Paragraph 1: Explain the lack of proper treatment for depression because of a lack of understanding between effect drugs have on patients
* Paragraph 2: Link above to a basic description of explanatory gap and need for models to research topics where this gap exists
  + Explain explanatory gap and how we don’t fully understand implications certain treatments that do, in some cases, work for patients
  + Understanding abnormal decision-making is required to fix it, causes of behaviors and where fault lines can break must be understood
  + Designing models to simulate these abnormalities help us better understand them and develop treatments for such models
* Paragraph 2: Link above topic to miscalibration
  + Go over the basic principles that entail miscalibration and note that we will go more in depth on the topic later in the paper.
  + The goal of this paper is to design a model that simulates miscalibration, which will ultimately allow researchers to better study and understand certain underlying causes for MDD.

**Background**

1. Describe BDT and review how it works
   * Built around BDT, so we need to use a planner that utilizes priors to act optimally in its partially observable environment
     + Set of states
     + Set of actions executed at each state
     + Utility function to determine value of executing action at such state (reward function)
     + Inference procedure (sample from Beta distribution/Dirichlet distribution, etc.)
     + All inference is Bayesian and built off of a structure of priors
2. Go more in depth on miscalibration and its link to depression
   * Miscalibration touches on three modes in which an agent acting optimally in its own partially observable environment, but sub optimally in the actual environment
     + Wrong problem: What problem are these patients solving?
       - Priors force a certain option to be believed or ruled out (a threat is coming, so when there is no threat, you still perceive it)
       - Agents overgeneralize rewards and punishments (i.e. low self-esteem generalizes to all failures)
       - Anhedonia, in which rewards lose their value over time
     + Wrong inference: How do they go about solving it?
     + Wrong environment: What previous experiences affect this patient?
3. Tie the two together by explaining how computational models provide an effective method for using BDT to explore conditions such as miscalibration.

**Related Work**

1. Describe different planners (BAPOMDP, POMCP, BAMCP), how they utilize Bayesian inference in decision-making
2. Explain other papers that developed algorithms/planners in order to explore psychiatric disorders (i.e. learned helplessness paper) and explain how we will use a similar method, but explore a different disorder.
3. Explain how we’re going to use the BAMCP
   * First, describe how under normal conditions BAMCP approaches the optimal policy
   * Next, explain how we’re going to use it to simulate miscalibration and segue into the next section

**Approach**

1. Restate goal and connect it to background
   * Again, our goal is to design an model that maintains normative behaviors, and then introduced certain factors that serve as underlying causes of miscalibration. In other words, create an agent that acts sub-optimally when introduced to conditions that cause miscalibration.
2. Include section on how we’re going to examine miscalibration in the three prongs that were noted in Decision-Theory Psychiatric paper
   * Overview what specific methods of miscalibration we’re going explore, and how we’re going to measure these results against the normative approach

**Implementation**

1. Explain basic implementation of BAMCP + miscalibration
2. Include separate section with methods and analyses/results for each of these modes of miscalibration, and different means by which they miscalibrated our agent and prevented it from acting optimally

**Conclusion**

1. Provide overview of the results
2. Reiterate motivation and touch on next steps (need for multi-state map for more in-depth research, such as cat and mouse)