Assignment 1

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1 Deviant aggressive behavior

Since most social policies are enacted by the government, most of my propositions will be related to the government but I will also mention other organizations including school, company, and community.

For Theory I, people learn deviant aggressive behaviors due to rewards and penalties. Thus, we can reduce those behaviors through rewards and penalties. For example, the government can establish a citizen rating system which is correlated to daily issues including the usage of credit card, the evaluation of default in loan and the admission to a university. If people once had deviant aggressive behaviors, their rating should be lower than those who did not. With such a rating system, people can receive rewards if they do not have deviant aggressive behaviors and get penalties once they have those behaviors. Also, the legislation department can design laws regarding the deviant aggressive behaviors so people who have those behaviors can be punished.

For Theory II, people feel frustrated because they have trouble in their work, interpersonal relationship, study or other issues in life. Plus, they cannot find an appropriate way to deal with bad emotions. To cope with this problem, the government can provide free mental health care in each community. Professional psychologists will give proper advice to those under great life pressure and help them to find a way to reduce the negative emotion. Also, companies, schools, and other organizations should be encouraged to keep a close watch on the mental condition of their members. Once the frustration can be eliminated, the deviant aggressive behavior will decrease.

For Theory III, people do not feel comfortable since the rules (i.e. laws) have impinged on their right and they want the government or organizations to modify the rules. To handle this problem, first, the government can establish a channel between the department of government and the public, through which the public can express their opinions about the current policy and rules. For example, the government can provide the public with several emails and each email is targeted at different problems. Plus, the government can set a committee to regulate the rules enacted and the committee has the right to prohibit the policy once it oppresses some of the public. Once we can eliminate those improper rules, those people who had been hurt by the rule will become optimistic and stop their deviant aggressive behavior.

For Theory IV, it is natural that people get in touch with a specific type of culture as they grow up and attend activities in society. However, people especially children can be prohibited from contacting with a deviant subculture through education. Thus, to reduce deviant aggressive behavior, the government and education organizations should improve the general education level of children and teenagers. For example, more education resources should be provided to rural areas. The government can provide funding to update the education infrastructures in those areas and hire experienced teachers for students. Then, those students are more likely to be taught the right value and stay away from the deviant subculture.

2 Waiting until the last minute

a. The observation is true because, firstly, those work mentioned in the question need people to spend time to finish but it is hard to feel happy when you write a paper or grade exams. Plus, people have many options other than doing hard things including writing homework and most people tend to do the easiest thing such as playing games or watching television. Thus, people prefer to wait until the last minute rather than finish the work as soon as they have the work.

b. Let's define a utility model to generalize the behavior in the question. In economics, utility is used to model worth or value. Suppose people have n options and $U(x_i), i = 1, 2, 3, ..., n$ denotes the utility of the ith option. In this question, we can approximately regard utility as the happiness we receive from our behavior. Thus, the utility of doing hard things is less than doing easy things (i.e. $U(things_{hard}) < U(things_{easy})$). Thus, people will prefer to do easy things such as watching TV rather than finishing those tough work.

c. Another possible model to explain this observation is the efficiency model. Suppose T denotes the time left before the deadline and E denotes the efficiency. Due to the fact that the deadline is coming, people will be encouraged to finish their work so their efficiency will be considerably improved. Thus, I induce a simple model for this theory.

$$E = \frac{a}{T} + b$$

Here, a is a parameter that denotes the effect deadline has on efficiency and b is the efficiency people originally have. Through this model, we know that people prefer to wait for the deadline because they have high efficiency.

d. For the utility model, the first prediction is that people will do their work as soon as possible once they cannot find another thing to do to feel happy. That is why we should put our phone and other entertainment away when we have much work. The second prediction is that once people have many options for entertainment, they will finish their work with low quality. That is why children who always play video games cannot get a good grade. For the efficiency model, the first prediction is that people who work very hard will set an early deadline to push themselves to finish the work with high efficiency even though the real deadline does not come. The second prediction is that people who always have

high efficiency will not rely on the deadline to improve their efficiency so they will not wait for the deadline.

3 Selecting and fitting a model

1. a. flexible method. A flexible method can better approximate the true model but it is more likely to overfit once the training set is small and the number of variables is large. However, in this case, we have a large training set and only a few variables so a flexible method will be better.

1. b. inflexible method. As mentioned in 1. a, if we choose flexible method with a small training set and many variables, we cannot handle overfitting. Thus, it is better to select an inflexible method.

1. c. flexible method. Once the relationship is highly non-linear and we use an inflexible method such as linear regression, we cannot perfectly fit the relationship. However, a flexible method including neural network can fit the relationship better.

1. d. inflexible method. The flexible method can fit the noise in the data and increase the variance of the fitting model.

2. a. **Bias**: As the model becomes more complex, the bias is decreasing and the model becomes more flexible. The form of bias is $E(\hat{f}(x_0) - f(x_0))$ and the first term is the model fitted by the data and the second term is the real model. As we use more complex model, the fitted model will become more close to the real model so bias decrease.

Variance: There exists a trade-off between bias and variance. Thus, as bias decrease, the variance will increase. in other words, the model will be more likely to overfit once it becomes more complex so it has high variance.

Training error: As the model becomes more complex, it is more close to the true model described by the training data so the training error will decrease.

Test error: Complex model tend to overfit so its generalization ability is bad when the model is too complex. However, the generalization ability can be bad once it is too simple, which is called underfitting. Thus, the shape of the curve is U-shape.

Irreducible error: It is a constant line because irreducible error will not change as the model changes.