Disclaimer: Studying this outline does not ensure that you will do well in the exam. In fact, just memorizing this outline will not help you solve the types of problems that you will have to solve in the exam. It will help you review the material in an organized way. Do not view this as a substitute to gaining a deep understanding of all lecture notes.

Chapter 1: The Market

A. Example of an economic model — the market for apartments
1. models are simplifications of reality
2. for example, assume all apartments are identical
3. some are close to the university, others are far away
4. price of outer-ring apartments is exogenous — determined outside the model
5. price of inner-ring apartments is endogenous — determined within the model

B. Two principles of economics
1. optimization principle— people choose actions that are in their interest
2. equilibrium principle

C. Constructing the demand curve
1. line up the people by willingness-to-pay. See Figure 1.1.
2. for large numbers of people, this is essentially a smooth curve as in Figure 1.2

D. Supply curve
1. depends on time frame
2. but we'll look at the short run — when supply of apartments is fixed.

E. Equilibrium
1. when demand equals supply
2. price that clears the market

F. Comparative statics
1. how does equilibrium adjust when economic conditions change?
2. "comparative" — compare two equilibria
3. "statics" — only look at equilibria, not at adjustment

G. Other ways to allocate apartments
1. discriminating monopolist
2. ordinary monopolist
3. rent control

H. Comparing different institutions
1. need a criterion to compare how e.cient these di.erent allocation methods are.
2. an allocation is Pareto effcient if there is no way to make some group of people better off without making someone else worse off.
3. if something is *not* Pareto efficient, then there *is* some way to make some people better off without making someone else worse off.

4. if something is not Pareto efficient, then there is some kind of "waste" in the system.

I. Checking efficiency of different methods
1. free market — efficient
2. discriminating monopolist — efficient
3. ordinary monopolist — not efficient
4. rent control — not efficient

Chapter 2: Budget Constraint

A. Consumer theory: consumers choose the best bundles of goods they can afford
1. this is virtually the entire theory in a nutshell
2. but this theory has many surprising consequences

B. Two parts to theory
1. "can afford" — **budget constraint**
2. "best" — according to consumers' **preferences**

C. Consumption bundle
1. (x_1, x_2) — how much of each good is consumed
2. (p_1, p_2) — prices of the two goods
3. m — money the consumer has to spend
4. budget constraint: $p_1x_1 + p_2x_2 \leq m$
5. all (x_1, x_2) that satisfy this constraint make up the **budget set** of the consumer. See Figure 2.1.

E. Two goods
1. theory works with more than two goods, but can't draw pictures.
2. often think of good 2 (say) as a composite good, representing money to spend on other goods.
3. budget constraint becomes $p_1x_1 + x_2 \leq m$.
4. money spent on good 1 (p_1x_1) plus the money spent on good 2 (x_2) has to be less than or equal to the amount available (m).

F. Budget line
1. $p_1x_1 + p_2x_2 = m$
2. also written as $x_2 = m/p_2 - (p_1/p_2)x_1$.
3. budget line has slope of $-(p_1/p_2)$ and vertical intercept of m/p_2.
4. set $x_1 = 0$ to and vertical intercept (m/p_2); set $x_2 = 0$ to and horizontal intercept (m/p_1).
5. slope of budget line measures opportunity cost of good 1 — how much of good 2 you must give up in order to consume more of good 1.

G. Changes in budget line
1. increasing m makes parallel shift out. See Figure 2.2.

2. increasing p_1 makes budget line steeper. See Figure 2.3.
3. increasing p_2 makes budget line flatter
4. multiplying all prices by t is just like dividing income by t
5. multiplying all prices and income by t doesn't change budget line
6. e.g. "a perfectly balanced in.ation doesn't change consumption possibilities"

I. Taxes, subsidies, and rationing
1. quantity tax — tax levied on units bought: $p1 + t$
2. value tax — tax levied on dollars spent: $p1 + \tau p1$. Also known as *ad valorem* tax
3. subsidies — opposite of a tax
   a) $p1 - s$
   b) $(1 - \sigma)p1$
4. lump sum tax or subsidy — amount of tax or subsidy is independent of the consumer's choices. Also called a head tax or a poll tax
5. rationing — can't consume more than a certain amount of some good

Chapter 3: Preferences

A. Preferences are relationships between bundles.
1. if a consumer would choose bundle (x_1, x_2) when (y_1, y_2) is available, then it is natural to say that bundle (x_1, x_2) is preferred to (y_1, y_2) by this consumer.
2. preferences have to do with the entire *bundle* of goods, not with individual goods.

B. Notation
1. $(x_1, x_2) \succ (y_1, y_2)$ means the x-bundle is **strictly preferred** to the y-bundle
2. $(x_1, x_2) \sim (y_1, y_2)$ means that the x-bundle is regarded as **indifferent** to the y-bundle
3. $(x_1, x_2) \succeq (y_1, y_2)$ means the x-bundle is **at least as good as** (preferred to or indifferent to) the y-bundle

C. Assumptions about preferences
1. complete — any two bundles can be compared
2. reflexive — any bundle is at least as good as itself
3. transitive — if $X \succeq Y$ and $Y \succeq Z$, then $X \succeq Z$
   a) transitivity necessary for theory of *optimal* choice

D. Indifference curves
1. graph the set of bundles that are indifferent to some bundle. See Figure 3.1.
2. indifference curves are like contour lines on a map
3. note that indifference curves describing two distinct levels of preference cannot cross. See Figure 3.2.
   a) proof — use transitivity

E. Examples of preferences

1. perfect substitutes. Figure 3.3.
    - a) red pencils and blue pencils; pints and quarts
    - b) constant rate of trade-off between the two goods
2. perfect complements. Figure 3.4.
    - a) always consumed together
    - b) right shoes and left shoes; coffee and cream
3. bads. Figure 3.5.
4. neutrals. Figure 3.6.
5. satiation or bliss point Figure 3.7.

F. Well-behaved preferences

1. monotonicity — more of either good is better
    - a) implies indifference curves have negative slope. Figure 3.9.
2. convexity — averages are preferred to extremes. Figure 3.10.
    - a) slope gets flatter as you move further to right
    - b) examples of non-convex preferences

G. Marginal rate of substitution

1. slope of the indifference curve
2. $MRS = \Delta x2/\Delta x1$ along an indifference curve. Figure 3.11.
3. natural sign is negative, since indifference curves will generally have negative slope
4. measures how the consumer is willing to trade off consumption of good 1 for consumption of good 2. Figure 3.12.
5. measures marginal willingness to pay (give up)
    - a) not the same as how much you have to pay
    - b) but how much you would be *willing* to pay

Chapter 4: Utility

A. What is a utility function?

- a) summarizes preferences
- b) a utility function assigns a number to each bundle of goods so that more preferred bundles get higher numbers
- c) that is, $u(x_1, x_2) > u(y_1, y_2)$ if and only if $(x_1, x_2) \succ (y_1, y_2)$
- d) only the ordering of bundles counts, so this is a theory of **ordinal utility**

B. Utility functions are not unique

1. if $u(x_1, x_2)$ is a utility function that represents some preferences, and $f(\cdot)$ is any increasing function, then $f(u(x_1, x_2))$ represents the same preferences
2. why? Because $u(x_1, x_2) > u(y_1, y_2)$ only if $f(u(x_1, x_2)) > f(u(y_1, y_2))$
3. so if $u(x1, x2)$ is a utility function then any positive monotonic transformation of it is also a utility function that represents the same preferences

C. Constructing a utility function

1. can do it mechanically using the indifference curves. Figure 4.2.
2. can do it using the "meaning" of the preferences

D. Examples

1. utility to indifference curves
    a) easy — just plot all points where the utility is constant
2. indifference curves to utility
3. examples
    a) perfect substitutes — all that matters is total number of pencils, so $u(x_1, x_2) = x_1 + x_2$ does the trick
        1) can use any monotonic transformation of this as well, such as $\log(x_1 + x_2)$
    b) perfect complements — what matters is the minimum of the left and right shoes you have, so $u(x_1, x_2) = \min\{x_1, x_2\}$ works
    c) quasilinear preferences — indifference curves are vertically parallel. Figure 4.4.
        1) utility function has form $u(x_1, x_2) = v(x_1) + x_2$
    d) Cobb-Douglas preferences. Figure 4.5.
        1) utility has form $u(x_1, x_2) = x_1^c x_2^d$
        2) convenient to take monotonic transformation
    $v(x_1, x_2) = \ln[u(x_1, x_2)] = c \ln x_1 + d \ln x_2$

E. Marginal utility

1. extra utility from some extra consumption of one of the goods, holding the other good fixed
2. this is a derivative, but a special kind of derivative — a *partial* derivative
3. this just means that you look at the derivative of $u(x_1, x_2)$ keeping x_2 fixed — treating it like a constant
4. examples
    a) if $u(x_1, x_2) = x_1 + x_2$, then $MU1 = \partial u/\partial x_1 = 1$
    b) if $u(x_1, x_2) = x_1^a x_2^{1-a}$ then $MU1 = \partial u/\partial x1 = a x_1^{a-1} x_2^{1-a}$
5. MU is closely related to MRS, which is an operational concept
    a) $u(x_1, x_2) = k$, where k is a constant, describes an indifference curve
    b) we want to measure slope of indifference curve, the MRS
    c) so consider a change (dx_1, dx_2) that keeps utility constant. Then
    $$MU_1 dx_1 + MU_2 dx_2 = 0, \text{or } \frac{\partial u}{\partial x_1} dx_1 + \frac{\partial u}{\partial x} dx_2 = 0$$
    Hence, $\frac{dx_2}{dx_1} = -\frac{MU_1}{MU_2}$.

The slope of the IC (MRS) = Ratio of Marginal utilities for good 1 and good 2. What is the intuition behind this result?

    d) so we can compute MRS from knowing the utility function

Chapter 5: Choice

A. Optimal choice

1. move along the budget line until preferred set doesn't cross the budget set. Figure 5.1.
2. note that tangency occurs at optimal point — necessary condition for optimum. In symbols: *MRS* = -price ratio = $-(p_1/p_2)$
   a) exception — boundary optimum. Figure 5.3.
3. tangency is not sufficient. Figure 5.4. - unless indifference curves are convex and optimum is interior (Condition 2 given in class).
4. optimal choice is demanded bundle
   a) as we vary prices and income, we get demand functions.
   b) want to study how optimal choice — the demanded bundle – changes as price and income change

B. Examples

1. perfect substitutes: $x_1 = m/p_1$ if $p_1 < p_2$; 0 otherwise. Figure 5.5.
2. perfect complements: $x_1 = m/(p_1 + p_2)$. Figure 5.6.
3. neutrals and bads: $x_1 = m/p_1$.
4. concave preferences: similar to perfect substitutes. Note that tangency doesn't work. Figure 5.8.

5. Cobb-Douglas preferences – *learn how to solve for optimal choice using calculus!*

D. Calculus Solutions in the Appendix

1. Using the *MRS* condition:
   - At point of optimal choice, budget line is tangent to indifference curve
   - This implies: slope of IC = slope of budget line
   - $MRS = -p_1/p_2$ is one equation
   - The budget constraint ($p_1x_1 + p_2x_2 = m$) is the other equation
   - We have two equations, and two unknowns (x_1, x_2). Can solve for x_1 and x_2.
2. Constrained Maximization:
   - max $u(x_1, x_2)$ s.t. $p_1x_1 + p_2x_2 = m$
   - This is a two variable maximization problem
   - Can convert this to a one variable maximization problem by substituting from the constraint into the utility function.
   - After substitution, we are left with maximizing u with respect to x_1.
   - We find the solution by setting $\frac{du}{dx_1} = 0$. WHY?

Chapter 6: Demand

A. Demand functions — relate prices and income to choices

B. How do choices change as economic environment changes?

1. Changes in income
   - a) this is a parallel shift out of the budget line
   - b) increase in income increases demand — **normal** good. Figure 6.1.
   - c) increase in income decreases demand — **inferior** good. (e.g. Ramen noodles)
   - d) as income changes, the optimal choice moves along the income expansion path **(income offer curve)**
   - e) the relationship between the optimal choice and income, with prices fixed, is called the **Engel curve**. Figure 6.3.
2. Changes in price
   - a) this is a rotation or pivot of the budget line
   - b) decrease in price increases demand — **ordinary** good. Figure 6.9.
   - c) decrease in price decreases demand — **Giffen** good. Figure 6.10.
   - d) as price changes the optimal choice moves along the **price offer curve**
   - e) the relationship between the optimal choice and a price, with income and the other price fixed, is called the **demand curve**

C. Examples

1. perfect substitutes. Figure 6.12.
2. perfect complements. Figure 6.13.

D. Substitutes and complements

1. increase in $p2$ increases demand for $x1$ — substitutes $\frac{dx_1}{dp_2} > 0$
2. increase in $p2$ decreases demand for $x1$ — complements $\frac{dx_1}{dp_2} < 0$

E. Inverse demand curve

1. We usually think of demand curve as measuring quantity as a function of price — but can also think of price as a function of quantity
2. this is the **inverse demand curve**
3. same *relationship*, just represented differently

Chapter 8: Substitution Effects and Income Effects

A. We want a way to decompose the effect of a price change into "simpler" pieces.
1. Break up into simple pieces to determine behavior of whole
2. When price decreases, two things happen:
a) relative prices change (one good becomes more attractive to buy relative to the other good)
b) Purchasing power of your money ("real" value of income) increases

B. Break up price change (budget line rotation) into a **pivot** and a **shift** — see Figure 8.2.
1. these are hypothetical changes (we draw an imaginary line)
2. we can examine each change in isolation and look at sum of two changes

C. Change in demand due to pivot is the **substitution effect**.
1. this measures how demand changes when we change prices, keeping purchasing power fixed.
2. By drawing the imaginary line, the question we are asking: "how much would a person demand if he had just enough money to consume the original bundle?"
3. this isolates the pure effect of changing the relative prices
4. substitution effect *must* be negative. (if price of a good increases, it becomes relatively less attractive to buy, so "negative" means quantity moves opposite the direction of price

D. Change in demand due to shift is the **income effect**.
1. increase income, keep prices fixed
2. income effect can increase or decrease demand depending on whether we have a normal or inferior good

E. Total change in demand is substitution effect plus the income effect.
1. if good is normal good, the substitution effect and the income effect reinforce each other
2. if good is inferior good, total effect is ambiguous

F. Specific examples
1. perfect complements — Figure 8.4.
2. perfect substitutes — Figure 8.5.
3. quasilinear — Figure 8.6.

G. Slutsky Equation