Final Exam Review Questions

1. The mean amount of time required by an appliance repairman to fix a washing machine is 48 minutes with a standard deviation of 6 minutes. At least what percent of the machines should take between 30 and 66 minutes to repair?

2. Answer the following unrelated probability questions:
   (a) If P(A) = 0.2, P(B) = 0.4 and the events A and B are statistically independent, what is the value of P(A or B)?
   (b) Two events K and L are mutually exclusive. P(K) = 0.56 and P(L) = 0.32. Find P(K and L).
   (c) Given that P(A|B) = 0.4 and that A and B are statistically independent, find P(A).
   (d) Two events S and T are mutually exclusive. P(S) = 0.56 and P(T) = 0.32. Find P(S or T).

3. Answer the following unrelated counting questions:
   (a) When you play a game called Pai Gow poker you can *win, lose,* or *tie*. If you play 4 games, how many different outcomes are possible?
   (b) 15 students apply for an ICBC scholarship. ICBC will pay out 3 scholarships; one for $5,000, one for $2,500 and one for $1,000. In how many different ways can these scholarships be awarded?
   (c) An early retirement package is offered to a group of 15 employees with the stipulation that only 5 employees will be able to take advantage of this offer. In how many ways can this offer be accepted by this group of employees?

4. Twenty percent of the employees of a large company are female. Find the probability that in a random sample of 15 employees, at least two are female?

5. Customers arrive at a supermarket checkout counter randomly and independently of each other at an average rate of 1 every 2 minutes during peak hours.
   (a) What is the probability that during peak hours at least one customer arrives in the next 5 minutes?
   (b) What is the probability that exactly 4 customers arrive in the next 5 minutes?
   (c) During the peak time, how many customers would you expect in a one hour period of time?

6. A salesperson sells only encyclopaedias and dictionaries. When she calls on a household, 40% of the time she is able to sell an encyclopaedia and 50% of the time she is able to sell a dictionary. If the sale of the two items are independent (but not mutually exclusive),
   (a) Find the probability that she can sell both an encyclopaedia and a dictionary on the same call?
   (b) Find the probability that she will be able to sell at least one of them-either a dictionary or an encyclopaedia?

7. For the last taxation year, 6 taxpayers each paid $180 to have their income tax return prepared. Eight other people paid $200 each and another six paid $270 each. What was the average fee paid by this group of individuals?

8. You are thinking about investing money $5,000 in the stock market. You have narrowed your choices to one of two stocks: Norvelle Networks or First National Bank.
   For Norvelle Networks you have the following statistics:
   - Mean monthly closing price: $20.00
   - Sample standard deviation: $4.00

   The monthly closing stock prices of First National Bank for the last 8 months is shown below:

($) 97 94 88 95.5 83.5 97.5 98.5 94

(a) Calculate the mean stock price of First National Bank.
(b) Calculate the standard deviation for the sample prices of First National.
(c) What is the median stock price for First National?
(d) What is (are) the mode(s), if any?
(e) What is the range in First National's stock price?
(f) Calculate the coefficient of variation for both stocks. Interpret.
(g) Develop the 5-number summary and sketch a boxplot of the monthly closing stock prices of First National Bank. Describe its shape.

9. A few years in the future, tax cuts have created a booming economy. You run a small tree planting business out of Terrace and have become concerned that you will have trouble recruiting students to plant this summer. Tree planters are paid per tree planted. You review data for the past few seasons and discovered that the average tree planter earns $95 per day with a standard deviation of $20. The distribution is normal.
   (a) Employment forecasts indicate that most students will not accept a job that pays less than $70 per day. What percentage of your planters make less than this minimum?
   (b) You decide to increase the average wage you pay to your planters by paying them a fixed daily allowance in addition to the money they earn planting. How large of an allowance should you pay so that 95% of planters make $70.00 or more per day?
   (c) Another company has decided to pay more for each tree planted. They expect a new mean of $105 and a standard deviation of $25 the distribution is normal. A random sample of 20 planters showed an average wage of $110. If the expected mean and standard deviation are correct, what percentage of sample means of size 20 would be less than $110?

10. According to a recent poll, 40% of families surveyed preferred to purchase a minivan instead of a car. If 8 families are selected at random what is the probability that
   (a) Exactly three families will prefer to purchase a minivan instead of a car?
   (b) At least two families will prefer to purchase a minivan instead of a car?
   (c) At least six families will prefer to purchase a car over a minivan?

11. Burn Rubber, a tire manufacturer, produces tires that last, on average, 75,000 km with a standard deviation of 5,000 km. Tire mileage is approximately normally distributed.
   (a) What percentage of tires will last between 78,000 and 87,500 km?
   (b) What is the minimum mileage of the longest lasting 10% of the tires?
   (c) If you randomly select a sample of 4 Burn Rubber tires, what is the probability that the sample mean mileage of the tires would be at least 85,000 km?

12. What is the average rate of return on an investment portfolio containing the following: $6,000, which earned 7.75% per annum; $12,000, which earned 9.25% per annum; and $22,000, which lost 5% per annum?

13. A machine fills 16 ounce soft drink bottles. The machine can be adjusted to pour, on average, any amount of soft drink into these jugs. However, the machine does not pour exactly the same amount of soft drink in each bottle; it varies from bottle to bottle. It is known that the net amount of liquid poured into each bottle has a normal distribution with a mean of 16.1 ounces and a standard deviation of 0.09 ounces. The quality control inspector wants to adjust the machine so that 98% of the jugs have at least 16 ounces of soft drink. What should the mean amount of soft drink poured into these bottles be increased to?

14. You are the controller for a restaurant chain. One day two chefs appear at your door. They have been arguing about toast; one says the other makes his toast too dark. They know you have taken a statistics course and ask you to tell them how to determine customers' toast preferences. You tell them to sample about 100 customers. They return in a few days and tell you they sampled 92 random customers and found 13 liked their toast "very dark".
    (a) What is your point estimate of the proportion of customers who like their toast "very dark"?
    (b) What is a 96% confidence interval estimate of the true proportion of customers who like their toast "very dark"?
    (c) What do you need to check to ensure your method is accurate?
    (d) How many customers would you tell them to sample if they want to be 99% certain that their estimate is accurate to within 2%?

15. A management consulting firm wishes to estimate the average wage earned by workers in a certain industry. The firm wants the maximum error on the estimate to not exceed $2. It is assumed that the population standard deviation is $10. If the cost of interviewing each worker is $5.00, and the total budget for the study is $500, what level of confidence should be used-- 95% or 98%?

16. A survey of 500 randomly selected automobile owners was questioned on the main reason they had purchased their current automobile. The results are given below.

	Styling	**Engineering**	**Fuel Economy**	**Total**
Male	70	130	150	
Female	30	20	100	
Total				

    (a) What is the probability that a randomly automobile owner is a male?
    (b) What is the probability that the automobile owner is a male whose main reason for purchasing the automobile was engineering?
    (c) What percentage of automobile owners chose engineering as their main reason for purchasing an automobile?
    (d) What percentage of male automobile owners chose engineering as their primary reason for purchasing automobile?
    (e) What percentage of females chose engineering as their primary reason for purchasing automobile?
    (f) Among the 500 automobile owners, who is more likely to choose engineering as their main reason for purchasing an automobile-men or women?
    (g) Among those automobile owners for whom engineering was the main reason for purchasing an automobile, what is the probability that they are male?
    (h) Does the data provide sufficient evidence of differences between men and women as to their main reason for purchasing an automobile? Test at a 5% level of significance.

17. A new brand of breakfast cereal called SNAX is being market tested. One hundred boxes of the cereal were given to consumers to try. The consumers were asked whether they liked or disliked the cereal. You are given their responses below:

Response	Frequency
Liked	60
Disliked	40
	100

(a) What is the point estimate of the proportion of people who will like SNAX cereal?
(b) What is the margin of error at the 95% confidence level?
(c) Construct a 95% confidence interval for the true proportion of people who like SNAX cereal.
(d) How many more consumers would your need to sample if you want to reduce the margin of error of to 6% or less at a 95% confidence level?
(e) Suppose that you want to estimate what percent of consumers enjoy eating cereal as a nighttime snack. How large of a sample would you need to take to obtain a margin of error of only 5% at the 95% confidence level?

18. You work for a large bank. Historically, 20% of homebuyers go to a mortgage broker to apply for a mortgage rather than dealing directly with a bank. You believe that because people are becoming more financially sophisticated, the percentage of homebuyers who use a mortgage broker has increased. You take a random sample of 400 recent homebuyers and found that 100 of them used a mortgage broker.
(a) Test at the 3% level of significance if their sufficient evidence to confirm your belief.
(b) If H_0 is true, find the probability of getting a value as large or larger than 100 out of 400.
(c) What does the probability in part (b) represent?

19. A soft drink filling machine, when in perfect adjustment, fills the bottles with 12 ounces of soft drink. A random sample of 23 bottles is selected, and the contents are measured. The sample yielded a mean content of 11.80 ounces, with a standard deviation of 0.50 ounces. Assume that the amount of soft drink dispensed is normally distributed.
(a) At the 10% level of significance can you conclude that the machine is not in perfect adjustment?
(b) Estimate the p-value.

20. A consumer organization wants to know whether there is a difference in the price of a particular toy at three different types of stores. The price of the toy was checked in a sample of 5 discount toy stores, 4 variety stores and 3 department stores. The results are below:

	Discount Toy	**Variety**	**Department**
	$15	$16	$20
	$12	$14	$18
	$15	$14	$16
	$15	$18	
	$13		
Sample Mean	**$14**	**$15.50**	**$18**

(a) Compute the grand mean.
(b) Compute SSA and MSA.
(c) Compute SSW and MSW.
(d) Fill out the ANOVA table.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_{test}
Among Groups				
Within Groups				
Total				

(e) Is there evidence of a significant difference in the average prices of the toy at the three types of stores? Test at the 5% level of significance. Assume the standard deviations of the populations are similar for the different store types.

21. Consumer Report has become aware that all the glowing reports about the reliability of the Novo Motor Company's Juniper model may be overstated. Consumer Report has paid for a statistical study to estimate the proportion of Juniper's cars requiring major warranty repairs. Consumer Report takes a random sample of 100 of Juniper's 2-year old cars and finds that 9 of them required major warranty repair.
    (a) Construct a 95% confidence interval for the true *percentage* of Juniper models requiring major warranty repairs.
    (b) Novo's management is very concerned about this percentage and decides to have an independent research agency do a much larger sample to be 95% confident that the error on the estimate is at most 1%. How large of a sample do they need?
    (c) What would your answer have been if you had not known the results of your sample of 100 Juniper cars?

22. The customer service department of Max Financial Services would like to estimate the average length of time between the receipt of a customer's application for conducting on-line financial transactions and the actual connection of the service. A random sample of 16 clients resulted in the following number of days to establish the service connection:

10	6	12	9	10	7	3	11
12	15	8	12	14	9	10	5

Answer the following questions:
    (a) Construct a 98% confidence interval for the true mean time required for connection of the service.
    (b) What assumption is necessary in part (a) above?
    (c) The margin of error from part (a) was considered too large. How large a sample must be taken in order to be 98% confident that the margin of error will be 1 day or less? Assume that the sample standard deviation is a reasonable estimate of the population standard deviation.
    (d) In a new study, it was found that 96 out of 240 clients interviewed stated that they were dissatisfied with how long it took to establish the service connection. Construct a 90% confidence interval for the true proportion of customers who are dissatisfied with the connection time.

23. One year ago, the production of Cereal-Os was moved from Vancouver to Sudbury. This has resulted in a massive change in staff. The production manager wants to see if this has decreased the production rate. The Vancouver plant averaged 200 thousand boxes of Cereal-O's per week. In the past 50 weeks (there was a 2-week holiday shutdown); the average production was 196.5 thousand boxes per week, with a standard deviation of 16 thousand boxes per week.
    (a) Test at the 1% significance level if the production rate has decreased.
    (b) Estimate the p-value. Based on the p-value would you reject H_0? Why or why not?

24. A huge cruise ship has a large number of staterooms. The cost, per stateroom, of a 7-day Caribbean cruise is normally distributed with a mean of $3,300 and a standard deviation of $1,200.
    (a) The occupants of the most expensive 15% of staterooms are invited to the captain's table. What is the minimum price of the most expensive 15% of the staterooms?
    (b) There are 264 staterooms that cost $1,800 or less. How many staterooms are there on the cruise ship?
    (c) If a random sample of 16 staterooms is chosen, what is the probability of the sample mean price being between $3,500 and $4,000?

25. The sailing time of the Queen of Coquitlam between Horseshoe Bay and Departure Bay is normally distributed with a mean of 95 minutes and a standard deviation of 10 minutes.
    (a) What is the probability the ship will make the trip in less than 85 minutes?
    (b) BC Ferries would like to guarantee that 95% of the time the ferry will arrive on time. The schedule allows 100 minutes for a trip. Are they meeting their goal?
    (c) BC ferries would like to reduce the percentage of late sailings to 5%. They propose to do this by instituting new docking procedures which they feel will greatly reduce the standard deviation. What standard deviation will allow them to achieve their goal? (assume the mean and scheduled times remain the same).

26. You own a company called Manly Maids which provides gardening, handyman and other services. You are planning on sending out brochures to solicit new customers. You would like to advertise that women who use this service are more satisfied with their marriage. You take a random sample of 400 married women and ask them about their level of satisfaction in their marriage and whether or not they have a gardener/handyman. The results are summarized below:

	Very Satisfied	**Somewhat Satisfied**	**Not Satisfied**	**Total**
Handyman	100	40	20	160
No Handyman	120	40	80	240
Total	220	80	100	400

Part 1 – Answer the following questions:
    (a) What percent of women without a handyman are very satisfied with their marriage?
    (b) What percent of women are either very satisfied or somewhat satisfied with their marriage?
    (c) Among those women who have a handyman, what percent are either very satisfied or somewhat satisfied with their marriage?
    (d) If a woman is **not** satisfied with her marriage, what is the probability that she does **not** have a handyman?

Part 2
At the 1% level of significance, is there enough evidence to prove that a woman's level of marital satisfaction is dependent upon having a handyman?

27. A graduate management school has been investigating the starting salaries of its graduates. One avenue of investigation looked at the relationship between work experience and starting salary. A sample of ten students was selected and the results are summarized below (work experience is in years and salary is in thousands):

Work experience	0	1	2	2	3	5	4	6	5	7
Salary in $1,000's	45	50	55	57	60	64	60	69	67	73

(a) Do a scatter plot on graph paper
(b) Calculate the least squares regression equation.
(c) Plot the regression line.
(d) Interpret the slope and intercept.
(e) Calculate and interpret the coefficient of determination (r^2).

Part 2

The school has also been looking at average grade as a predictor of future earnings. Average grades were used to explain starting salary and the results of a sample of ten students are summarized in the excel output below. (*The units of the average grade were based on a **mark out of 100** and the **starting salary was represented in thousands of dollars**.)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.856018
R Square	0.732766
Adjusted R Square	0.699362
Standard Error	4.813435
Observations	10

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2.809553	11.92396	0.235622	0.819645	-24.6872	30.30627
Grade	0.715639	0.152796	4.683625	0.001574	0.363291	1.067987

(a) Is grade or experience a better predictor of starting salary? Use statistics to support your argument.
(b) A friend graduated with an average of 78. What salary can she expect upon graduation?
(c) Test at the 5% significance level if there is a linear relationship between grade and starting salary.

28. An insurance company wants to know how the amount of life insurance depends on the income of the policyholder. The research department at the company collected information on six policyholders. The following table lists the annual income (in thousands of dollars) and amounts of life insurance policies (in thousands of dollars) for these six policyholders.

Life insurance **($1,000's)**	Annual Income **($1,000's)**
250	47
300	54
100	25
150	37
500	62
80	18

The Excel regression output is shown below. Note: the two coefficients and other regression information missing!

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**?**
R Square	**?**
Adjusted R Square	0.848392815
Standard Error	**?**
Observations	6

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	108960.5673	108960.6	28.97997	0.00575592
Residual	4	15039.43272	3759.858		
Total	5	124000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	**?**	69.95041	-1.73874	0.157069	-315.8392	72.58776
Annual Income ($1,000's)	**?**	1.612785	**?**	0.005756	4.204305	13.15992

(a) What is the independent variable, and what is the dependent variable?
(b) Use the data given and your calculator to find the estimated regression line.
(c) What is the meaning of the slope? Interpret it using the words of the problem.
(d) What is the predicted amount of life insurance for a person with an annual income of $54,000?
(e) What is the value of r^2 (coefficient of determination)? Interpret what it means using the words of the problem?
(f) Test at the 5% significance level if there is a linear relationship between annual income and the amount of life insurance purchased.
(g) Calculate the standard error.

29. The sales manager for Global wants to see if there is a difference in the effectiveness of the various closing methods used to close a sale. Three different sales closing methods were used. Three groups of six salespeople were randomly chosen. Each group was instructed to use only one of the closing methods. Sales totals of each salesperson over the next two weeks were collected. Following are sales results for all 18 salespeople:

Sales Group → / Treatment →	**Group 1** / **Method 1**	**Group 2** / **Method 2**	**Group 3** / **Method 3**
	16	19	24
	21	20	24
	18	21	22
	13	20	25
	19	21	25
	15	19	21

Sample Mean	17	20	23.5

(a) Compute the grand mean.
(b) Fill out the ANOVA table:

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_{test}
Among Groups				
Within Groups				
Total				

(c) Is there evidence of a significant difference in the average sales levels of the three sales methods? Test at the 1% level of significance. Assume the standard deviations of the populations are similar for the different methods.

Solutions:

1. at least 89%
2. (a) 0.52 (b) 0 (c) 0.40 (d) 0.88
3. (a) 81 (c) 2,730 (d) 3,003
4. 0.8329
5. (a) 0.9179 (b) 0.1336 (c) 30 customers per hour
6. (a) 0.20 (b) 0.70
7. $215
8. (a) $93.50 (b) s = $5.18 (c) $94.75 (d) $94 (e) $15
(f) $CV_{\text{Norvelle Networks}}$ = 20% and $CV_{\text{First National Bank}}$ = 5.5%
(g) Xmin = $83.50; Q1 = $91; Median = $94.75; Q3 = $97.25; Xmax = $98.50
The shape of the distribution is skewed to the left; or negatively skewed.
9. (a) 10.56% (b) $7.90 ($102.90 – $95) (c) 81.33%
10. (a) 0.2787 (b) 0.8936 (c) 0.3154
11. (a) 0.2681 (b) 81,400 km (c) z = 4.0 so almost zero
12. The average rate of return is 1.1875%.
13. 16.1845 ounces
14. (a) 0.1413
(b) 14.13043 ± 7.445. $0.067 \leq p \leq 0.216$ I am 96% confident that the true proportion of customer who like toast very dark is between 6.7% and 21.6%.
(c) $n\hat{p}$ = 13 > 5 and $n(1-\hat{p})$ = 79 > 5, therefore the central limit theorem is valid and we can use normal probability tables.
(d) 2,012 customers
15. at 98% confidence it costs $680 ($z$ = 2.33 and n = 136)
at 95% confidence it costs $485 ($z$ = 1.96 and **n** = 97)
Since $485 is the only cost that is below $500 use 95% confidence.
16. (a) 350/500 = 70% (b) 130/500 = 26% (c) 150/500 = 30% (d) 130/350 = 37.1%
(e) 20/150 = 13.3% (f) The answer is men. 37% of men chose engineering while only 13% of women did. Was this study done in the 1950's?? (g) 130/150= 86.7%
(h) H_0: A car buyer's main reason for buying an automobile is independent of their gender.
H_A: A car buyer's main reason for buying an automobile **depends** on their gender.

$\chi^2_{crit} = 5.99 > \chi^2_{test} = 31.73$ ∴ reject H_0. At the 5% level of significance there is enough evidence to conclude that a car buyer's main reason for buying an automobile depends on their gender.

17. (a) 0.60 or 60% (b) margin of error is 9.6%
(c) $0.504 \le p \le 0.696$ I am 95% confident that the true proportion of customers who like SNAX cereal is between 50.4% and 69.6%. (d) 157 more consumers (e) 385 consumers

18. p = true percentage of homebuyers who whose a mortgage broker
H_0: $p \le 20\%$ H_A: $p > 20\%$
$z_{crit} = 1.88$ and $z_{test} = 2.50$. $z_{test} > z_{crit}$ ∴ reject H_0 At the 3% level of significance there is enough evidence to conclude that more than 20% of homebuyers are using mortgage brokers.
(b) 0.0062 (0.62%) which is less than 3% so reject H_0
(c) the p-value

19. μ = true average amount of soft drink dispensed into each bottle
H_0: $\mu = 12$ ounces (machine is in perfect adjustment)
H_A: $\mu \neq 12$ ounces (machine is not in perfect adjustment)
$t_{crit} = \pm 1.717$ and $t_{test} = -1.92$ $t_{test} < -1.717$ ∴ reject H_0. At the 10% level of significance there is enough evidence to conclude that the machine is **not** in perfect adjustment and needs an adjustment.
(b) The p-value is between 5% and 10%.

20. (a) grand mean = \$15.50 (b) SSA = 30, MSB = 15 (c) SSW = 27, MSW = 3
(d)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_{test}
Among Groups	30	2	15	5
Within Groups	27	9	3	
Total	57	11		

(e) H_0: $\mu_{Discount} = \mu_{Variety} = \mu_{Department}$
H_A: not all population means are equal (*or* at least one mean is different)
numerator df = 2, denominator df = 9, $F_{crit} = 4.26$
$F_{test} = 5$
$F_{test} > F_{crit}$ ∴ Reject H_0
At the 5% significance level, there is just enough evidence to show there is a significant difference in the average prices of the toy for at least two of the store types.

21. (a) $3.4\% \le p \le 14.6\%$ I am 95% confident that the true proportion of Juniper model cars that require major warranty repair is between 3.4% and 14.6%.
(b) 3147 Juniper cars (c) 9,604 Juniper cars

22. (a) $t = 2.602$ $7.465 \le \mu \le 11.660$ days. I am 98% confident that the true mean time required for connection of the service is between 7.5 and 11.7 days.
(b) The distribution of time to connect in approximately normal
(c) 57 clients
(d) $0.348 \le p \le 0.452$ I am 90% confident that the true proportion of customers that are dissatisfied with their connection time is between 34.8% and 45.2%.

23. (a) H_0: $\mu \ge 200$ thousand boxes H_A: $\mu < 200$ thousand boxes

$t_{crit} = -2.4049$ and $t_{test} = -1.55$ $t_{test} > t_{crit}$ ∴ Fail to reject H_0. At the 1% level of significance there is not enough evidence to conclude that the production rate has decreased.
(b) p-value is between 5% and 10%. Greater than 1% so H_0 cannot be rejected.

24. (a) \$4,548 (b) 2,500 staterooms (c) 0.2415

25. (a) 0.1587 (b) No, only 69.15% are on-time (30.85% are late) (c) 3.0395 minutes

26. (a) 50% (b) 75% (c) 87.5% (c) 80%
H_0: A woman's level of marital satisfaction is independent of whether or not she has a handyman
H_A: A woman's level of marital satisfaction is dependent on having a handyman.
$\chi^2_{crit} = 9.21$ and $\chi^2_{test} = 22.73$
At the 1% significant level, there is enough evidence to conclude that a woman's marital satisfaction depends on having a handyman

27. (b) $\hat{y} = 46.9 + 3.74x$ y is in \$1,000's of dollars
(c) Make sure that your line goes through the point (3.5 years, \$60,000)
(d) Intercept: The expected (or predicted) starting salary for a graduate with no work experience is \$46,900 Slope: For every extra year of work experience we expect the starting salary to increase by \$3,740
(e) $r^2 = 96.6\%$ 96.6% of the variation in starting salary is explained (or accounted for) by the number of years of work experience
Part 2:
(a) Work experience is a better predictor because it has the higher r^2
(b) \$58,629
(c) β_1 = population slope between average grade and starting salary
H_0: $\beta_1 = 0$ H_A: $\beta_1 \neq 0$
$t_{crit} = \pm 2.306$ and $t_{test} = 4.68$. Reject H_0. At the 5% level of significance there is enough evidence to conclude that there is a linear relationship between grade and starting salary.

28. (a) Independent variable: Policy holder's annual income (in \$1,000's)
Dependent variable: Amount of life insurance purchased (in \$1,000's)
(b) $\hat{y} = -121.626 + 8.6821x$
(c) If the annual income increases by \$1,000 (\$1) we would expect the amount of life insurance purchased to increase by \$8,682 (\$8.68)
(d) 347,209 → \$347,000 (e) $r^2 = 87.87\%$ 87.87% of the variation in the amount of life insurance purchased is explained (or accounted for) by the policy holder's annual income.
(f) β_1 = the population slope between a policy holder's annual income and the amount of life insurance purchased.
H_0: $\beta_1 = 0$ H_A: $\beta_1 \neq 0$.
$t_{crit} = \pm 2.776$. $t_{test} = 8.6821/1.612785 = 5.38$. Reject H_0. At the 5% level of significance there is enough evidence to conclude that there is a linear relationship between a policy holder's annual income and the amount of life insurance purchased.
(g) $\sqrt{\frac{15039.43272}{6-2}} = 61.317682$

29. (a) grand mean = 22.6875
(b)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_{test}
Among Groups	127	2	63.5	16.0084

Within Groups	59.5	15	3.96667
Total	186.5	17	

H_0: $\mu_{\text{Method 1}} = \mu_{\text{Method 2}} = \mu_{\text{Method 3}}$

H_A: not all population means are equal (*or* at least one mean is different)

numerator df = 2, denominator df = 15, $F_{\text{crit}} = 6.23$

$F_{\text{test}} = 16.0084$

$F_{\text{test}} > F_{\text{crit}} \therefore$ Reject H_0

At the 1% significance level, there is enough evidence of a significant difference in the average sales levels of the three sales methods.