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An analysis of fouls committed in thirty intercollegiate basketball games and their effect upon successful team performance

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AN ANALYSIS OF FOULS COMMITTED IN THIRTY INTERCOLLEGIATE BASKETBALL GAMES AND THEIR EFFECT UPON SUCCESSFUL TEAM PERFORMANCE

Thesis

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

Basketball in this country is a sport in which interest is growing rapidly among both spectators and participants. Basketball coaches, players, and spectators of the game, hold many and varied opinions as to methods of improving the game. Of course, a great number of these theories or opinions are, in reality, unproven hypotheses which are founded primarily upon subjective judgement, rather than upon scientific fact.

I. THE PROBLEM

Statement of the problem. The purpose of this investigation has been to analyze the fouls committed during thirty intercollegiate basketball games and to determine the influence of fouling upon successful team performance.

The scope of the investigation has been to: (1) determine the relative frequency of fouling on the part of the offensive and defensive teams; (2) determine the relative frequency of the different types of fouls committed; (3) plot the areas of the basketball court where fouls occurred; (4) classify the types of fouls that were called by the referees; (5) calculate from the data collected, the difference between final scores and the number of successful and unsuccessful foul shots.

Justification for the study. With increasing public interest in basketball, accompanied by the pressure of developing outstanding teams, the coach's job has become one requiring application of considerable court strategy. In order that a coach produce a successful basketball team, he must not only have the playing material, but he also must possess scientific

knowledge of the game. With the application of the results of scientific investigation, a coach's job may become simplified and more interesting. Objective data in this area is very limited, and theory of the game has been of a rather empirical nature. Everett S. Dean, Director of Basketball at Stanford University states that "as the game of basketball becomes more and more scientific, the coach of this very popular sport should adopt a scientific attitude toward the game".[1]

Rules, in the game of basketball, in many instances change yearly, and as a result, these changes may alter the outcomes of the game in many ways. Rules may also affect the strategy of the coach. Thus, it is hoped that this study will serve as an aid and possible guide to the evaluation of certain opinions and concepts of basketball, through the application of objective statistical data collected under actual game conditions. The author has made every effort to keep the data as objective as possible in every phase of the study.

It is the opinion of the writer, that there are altogether too many fouls committed throughout the basketball season. As a result of this opinion, the writer believes that if the calling of fouls is not kept to a minimum during a game, the interest of the players and spectators alike will gradually diminish.

II. DEFINITIONS OF TERMS USED

The terminology used in this study was extracted from the Official National Basketball Guide for the season 1947-1948.

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[1]Dean, Everett S., Progressive Basketball, Stanford University, Stanford University Press, 1942, p. 54.

A foul. A foul is an infraction of the rules, the penalty for which is one or more free throws at the basket.

A personal foul. A personal foul is a player foul which involves contact with an opponent while the ball is in play.

A technical foul. A technical foul is: a foul which occurs while the play is suspended; or a foul by a non-player; or a foul which does not involve contact with an opponent.

A free throw. A free throw is the privilege given a player to score one point by an unhindered throw for goal from a position directly behind the free throw line.

A minor foul. A minor foul is one by which the player fouled may attempt one free throw at the opponent's basket.

A major foul. A major foul is one by which the player fouled may attempt two free throws at the opponent's basket.

Types of personal fouls. There are many types of personal fouls that may be called against an opponent. In the games considered in this study, the decisions of the referees were used as a basis for the typing of fouls. In many instances, the writer was at complete disagreement with the referee's decision. However, in order for this study to be as objective as possible, the writer accepted the referee's decision as final.

Holding. Holding is personal contact with an opponent that interferes with his freedom of movement.

Blocking. Blocking is personal contact which impedes the progress of an opponent who has the ball.

Pickoff. A pickoff is a type of block when a player disregards the ball, faces an opponent, and shifts his position as the opponent shifts.

Hacking. Hacking is personal contact with an opponent by slapping and hitting the arms of the player who has the ball.

Pushing. Pushing is personal contact with an opponent, which results in driving, forcing or lending momentum.

Charging. Charging is personal contact with an opponent, which results in forceable body contact.

Hooking. Hooking is personal contact with an opponent, which results in illegal use of the hands or body from the side or the rear of the opponent.

Hipping. Hipping is personal contact with an opponent by using the hips to push or charge the opponent.

Tripping. Tripping is personal contact with an opponent, by illegal use of the feet to cause the opponent to stumble or fall.

Unsportsmanlike Conduct. Unsportsmanlike conduct involves any action that is unsportsmanlike to the game, by any player, coach, substitute or team follower.

Types of technical fouls. It is very hard to define the various types of technical fouls, so the writer has listed some of the technical fouls that were considered in this study. They include: (1) interference of the proper conduct of the game by the spectators; (2) the failure of a substitute to report to the official scorer before entering or re-entering the game; (3) the failure of a substitute to report to an official of the game; (4) taking more than the official number of time-outs allowed; (5) the removal of a player from the playing court without the official's permission; (6) the calling of a time-out when the ball is in possession of the opponent; (7) the delaying of the game by an opponent who interferes with the ball while it is still in play; (8) the presence

of the coach or an extra man on the playing court without official permission; (9) the returning to the game of a player who has been disqualified; (10) leaving the circle on any jump ball before the ball has been tapped.

The writer realizes the difficulty involved in defining terms in basketball and is aware of the fact that much disagreement may result when it comes to basketball terminology.

CHAPTER II

REVIEW OF THE LITERATURE

There has been comparatively little published research dealing with the study of basketball methods, techniques, and strategy under game conditions. A recent study by Allen and Elbel[2] observing players under game conditions evaluated individual and team efficiency on the basis of certain offensive and defensive items. The items were classified as either positive or negative, and were ranked and weighted numerically in order to compute indices of "offensive playing efficiency", "defensive playing efficiency" and "composite playing efficiency". In this manner the authors were able to rate individual and team performance in terms of an efficiency index. The authors conclusions indicated that there is much helpful information available in basketball games which is not being used; that scoring ability may be offset by fouls and ball handling errors; and that mistakes are important game factors.

There have been a few studies that have attempted to indicate the influence which fouls committed and success at the free throw line have had on the outcome of the game. Staton[3] concluded that continuous performance and its probable accompanying fatique, showed a positive rather than negative effect upon free throw accuracy.

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2 Allen, F. C. and Elbel, E. R., "Evaluating Team and Individual performance in Basketball", Research Quarterly, XII, 3:538-555, October, 1941.

3 Staton, W. M., " A Study of Certain Factors Associated With Individual and Team Performance In Collegiate Basketball", Master's Thesis, Boston University, School of Education, June, 1947.

Mathes'[4] study indicates that in many cases the team fouled does not gain an advantage, because, "the practice of counting successful free throws as gross gain was not entirely justified in view of the fact that the teams fouled were deprived of the opportunity to score from the floor". The team fouled also lost possession of the ball if the free throw attempt is successfully converted.

Lorton[5] concluded in his study that free throwing ability and the ability to guard without fouling appear to be significantly related to winning in basketball. He also concluded that both officiating and free throwing are fairly uniform in the sector where the study was carried out.

The National Rules Committee of the Intercollegiate Basketball Association reported in the Official Basketball Guide[6] of 1931-1932, the results of research carried on during the 1930-31 basketball season. There were two main purposes of the study: (1) to plot the positions on the court where fouls occurred and; (2) to record the type of foul that was committed and the relative frequency with which it was committed. This data was to be collected from all parts

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4 Mathes, Lee, "A Study of The Net Gain In Points Resulting From Fouling In Basketball", Thesis, Graduate College of State University of Iowa, June, 1940.

5 Lorton, Frank M., "A Study of the Relationship of Fouls Committed and Free Throws Made To Winning and Losing In Basketball", Thesis, Graduate College of State University of Iowa, August, 1940.

6 Tower, Oswald, Official Basketball Guide, "Condensed Progress Report On Fouls", American Sports Publishing Co., New York, 1931-32.

of the country by many different recorders. This method lends to much subjectivity because of the inconsistency on the parts of the recorders. With the above purpose in mind, 2,000 analysis sheets were sent out to the larger colleges and universities. At the end of the 1930-31 basketball season, 279 of the original 2,000 analyses were returned for analysis. Some of the statements made by the committee, based upon the data that was collected for the study, were as follows: "(1) of the 279 games that were analyzed, 139 of the games were either positively decided by fouls; (2) the five fouls most frequently committed, in their order of frequency were, pushing, holding, hacking, blocking and charging; (3) 51.3 per cent of the fouls attempted, were shot from the free throw line by the winning team; (4) 47.8 per cent of the fouls attempted, were shot from the free throw line by the losing team; (5) the calling of fouls presents approximately a 20 per cent advantage to the winning team".[7]

Data were also collected from three championship series. The date on fouls from the series were kept as accurately as possible. The data were gathered on the same type analysis sheets by the same recorders during each game. "Fifty five per cent of these championship games, played by teams of high standing under conditions of excellent officiating were definitely affected by the fouls committed or converted. It is interesting to note that when an attempt was made to relate the size of the score with the number of fouls committed,

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[7]Tower, Oswald, Official Basketball Guide, American Sports Publishing Co., 1931-32, page 7.

the scattergram showed no relationship pattern whatever and therefore no coefficient of correlation was secured. For that reason it was safe for the committee to conclude that with these three championship series there was no correlation between the size of the score and the number of fouls committed or converted. From this it can at once be seen that one method of reducing the importance of fouls is to increase the number of field goals, thus increasing the size of the score. As there was no correlation made between the size of score and the number of fouls converted, increasing the number of field goals and therefore the size of the score, the relative value of the foul is decreased. 94.5 per cent of the fouls committed in these three championship series were called against the defensive team. Only forty three fouls out of the total of 785 fouls that were committed were called against the team in possession of the ball."[8]

In the Official Basketball Guide for the 1933-34 intercollegiate basketball season, the article "Further Report of The Sub-Committee on Fouls" was published. The committee approached the problem of gathering their data by the same method as 1930-31. This time 270 analysis sheets were returned representing data collected from 270 basketball games from all parts of the country during the 1932-33 intercollegiate basketball season. The purposes of this study were the same as those of the 1930-31 season. The following statements were made by the committee regarding data gathered during the 1932-33 season; (1) "while there were just under 3,000 fouls committed in the

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[8]Tower, Oswald, Official Basketball Guide, American Sports Publishing Co., 1931-32, page 8.

279 games during 1930-31 season, there were 4,800 fouls committed in 270 games during the 1932-33 season, the difference of some 1,800 fouls being committed was due to the fact the 10 second rule, which forced offensive play; (2) the five fouls most frequently committed, in order of their frequency were, holding, pushing, charging, hacking and blocking".[9] This article was very sketchy and no further mention was made about correlating the size of the score and the fouls converted, and no mention was made about collecting data from any championship games of any type.

The data of these studies were highly subjective and a study more rigidly controlled should be of value.

The following appear to be basic weaknesses in the studies carried out by the National Rules Committee:

1. The return of only 13.5 per cent of the analysis sheets sent out does not constitute a satisfactory return from which generalizations are justified.
2. The studies do not indicate the competency of the recorders nor is any mention made as to the specific instructions under which they operated.
3. The chart system that was used to show where the fouls were committed consisted of only two zones. It is doubtful if this represents enough zones for a study of this type.

The writer believes that these weaknesses have been controlled to a certain degree in this study.

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[9]Tower, Oswald, Official Basketball Guide, American Sports Publishing Co., 1933-34.

CHAPTER III

TECHNIQUES AND PROCEDURES

In this study, the writer attempted to utilize objective tools for recording and statistically analyzing the data. There was also an effort made to select a group of teams which would be both representative and adequate for the purpose of the research.

I. THE GROUP STUDIED.

Description of the group. This study was carried out during the 1947-1948 season of intercollegiate varsity basketball at the Boston Garden and Boston Arena, Boston, Massachusetts. Thirty games were included in this study, during which data was collected on both of the competing teams. Twenty five different colleges and universities were represented in the collecting of the data. A total of well over four hundred individual players were included in the investigation. Although eastern teams were predominant in the sampling, schools from other sections of the nation appeared over the course of the season. The group by geographical sections showed sixteen eastern teams, five mid-western, two southern and two from the far west.

II. METHODS AND MATERIALS USED.

Charting method. Most of the data collected for the study was recorded on a chart designed by the writer for this purpose (Figure 1). The game time was arbitrarily divided into eight periods of five minutes each and a separate chart used for each period. Therefore, the data for

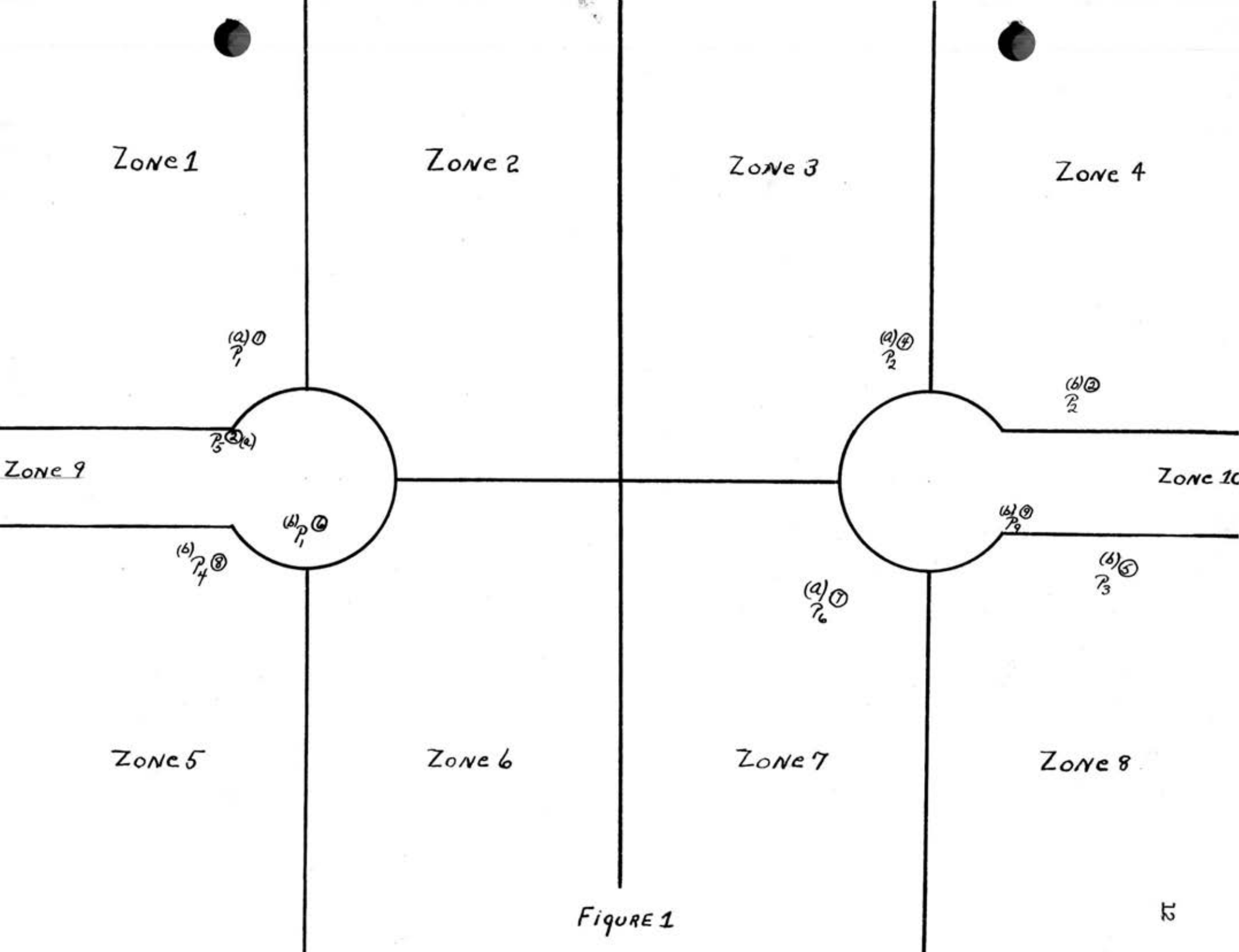
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Zone 9
Zone 10
(a) ① P1
(a) ④ P2
(b) ② P2
(b) ③ P5
(b) ⑨ P9
(b) ⑤ P3
(b) ⑥ P1
(b) ⑧ P4
(a) ⑦ P6

FIGURE 1

a complete game was recorded on eight charts. Notation of the last four minutes of the game was made, only when the score of the game was one of less than a ten point difference at this time.

The approximate position on the basketball court where each foul was committed, was recorded on the chart. Symbols were used to designate the type of foul that was committed. The circled number represents the sequence of the foul. (1) the first foul called, (2) the second foul called, etc. The letter "P" or "T" represents the kind of foul, whether personal or technical. The numbers under "P" and "T" represent the type of foul that was committed. P_1 represents a hacking foul. P_2 represents a charging foul. T_4 represents more than five time outs. T_2 represents failure of a player to report to an official. The letters "a" and "b" were used to indicate whether the foul was committed by the offensive team or the defensive team.

A running score of each game was kept on a separate sheet of paper. The player who committed the foul, whether a forward, a guard, or the center, within limitations of the recorders observation, was also kept on the sheet along with the running score.

Types of offense and defense according to fast break, slow break, zone, and shifting man-to-man were not recorded in the study, due to the complexity of play that was used by the various teams represented.

Duties of the recorder. The writer collected all of the data on the thirty games studied. Observation and recording was carried on in the press box at each game. Charting for the entire study was done by the writer so that errors of subjective judgement might be kept constant and at a minimum.

It was the duty of the recorder, when collecting the data shown in Figure 1, to use a red pencil when denoting fouls committed by the home team and a blue pencil when denoting fouls committed by the visiting team.

CHAPTER IV

DISCUSSION OF DATA

This chapter will be concerned with reporting the findings and results of the study in relation to each of the individual phases of the problem.

The hypotheses used in this study were; (1) that winning teams committed fewer fouls then losing teams; (2) that winning teams converted more foul shots than losing teams; and (3) that the losing teams missed more free throws. It was also assumed that as the difference in score increased between winning and losing teams, the difference in conversions increased in the same direction.

The relationship between differences in score and fouls committed. In this study, the results will be referred to solely in terms of winning teams and losing teams. Table I shows the number of fouls committed by the winning and losing teams in the thirty intercollegiate games observed. This table shows that the winners committed less fouls over the total number of games then did the losers.

The relationship between the differences in score and fouls converted. Table II indicates the frequency with which the fouls were converted in this study. This table shows that winning teams converted more free throws then did the losing teams. There were four games in which the final score difference did not exceed six points. Of these four games two games were tied at the end of the official game time and an overtime period was played to decide the winner. It may be stated that in these four game situations, the number of fouls converted were

TABLE I

FOULS COMMITTED BY WINNERS AND LOSERS

Designation	Game Number	Winners	Losers
A	8	18	18
B	13	24	12
C	29	17	13
D	4	28	25
E	15	5	10
F	9	15	18
G	10	12	15
H	3	21	16
I	26	22	17
J	18	13	19
K	24	21	18
L	21	24	26
M	19	9	14
N	17	15	17
O	5	18	20
P	7	18	20
Q	30	19	16
R	27	17	12
S	6	21	22
T	23	12	16
U	2	18	18
V	14	14	21
W	12	18	22
X	22	15	15
Y	20	12	14
Z	11	22	30
AA1	16	13	20
BB1	28	26	24
CC1	1	16	21
DD1	25	12	16
	N 30	Total 515	Total 545

TABLE II

FOULS CONVERTED BY WINNERS AND LOSERS

Designation	Game Number	Winners	Losers
A	8	11	11
B	13	7	15
C	29	9	4
D	4	16	18
E	15	6	6
F	9	11	9
G	10	12	11
H	3	15	15
I	26	7	11
J	18	15	9
K	24	12	14
L	21	18	17
M	19	9	8
N	17	11	6
O	5	16	11
P	7	16	10
Q	30	13	6
R	27	11	14
S	6	17	13
T	23	8	8
U	2	10	11
V	14	19	10
W	12	17	15
X	22	20	13
Y	20	10	4
Z	11	18	17
AA1	16	17	12
BB1	28	17	15
CC1	1	13	12
DD1	25	10	9
	N 30	Total 391	Total 334

Winners percentage - 60.34%
Losers percentage - 57.98%

a deciding factor in winning or losing of the game.

The relationship between the differences in score and fouls missed. Table III indicates the frequency with which the fouls were missed in this study. This table shows that winners missed more conversions then did the losers because they had more free throw attempts; however, by proportion the winners did not miss as many free throws as did the losers.

Correlations between the differences in scores and the differences between fouls committed, fouls converted, and fouls missed. Using the Pearson-product moment method, correlations were computed between the following items: (1) the relationship between the differences in scores and the differences in fouls committed by the winning and losing teams; (2) the relationship between the fifferences in scores and the differences in the fouls converted by the winning and losing teams; (3) the relationship between the differences in scores and the differences in the fouls missed by the winning and losing teams.

The following correlations for the observed items were obtained:

r01 . . . . . .40 ± .10

r02 . . . . . .28 ± .11

r03 . . . . . .17 ± .11

ro = the difference in score between the winning and losing teams.

r1 = the difference in fouls committed between the winning and losing teams.

r2 = the difference in fouls converted between the winning and losing teams.

r3 = the difference in fouls missed between the winning and losing teams.

TABLE III

FOULS MISSED BY WINNERS AND LOSERS

Designation	Game Number	Winners	Losers
A	8	8	6
B	13	6	13
C	29	5	8
D	4	15	11
E	15	4	2
F	9	8	4
G	10	8	7
H	3	7	8
I	26	13	14
J	18	8	7
K	24	9	9
L	21	15	9
M	19	5	3
N	17	8	7
O	5	9	15
P	7	11	8
Q	30	6	12
R	27	5	11
S	6	10	10
T	23	8	6
U	2	10	10
V	14	7	5
W	12	11	6
X	22	3	4
Y	20	7	7
Z	11	14	11
AA1	16	9	4
BB1	28	10	15
CC1	1	10	4
DD1	25	8	6
	N 30	Total 257	Total 242

Winners percentage - 39.66%
Losers percentage - 42.02%

The correlation of .40 indicates that there is some relationship between the differences in scores and the differences in fouls committed by the winning and losing teams. The correlation of .28 indicates that there is no relationship between the differences in scores and the differences in the fouls converted by the winning and losing teams. The correlation of .17 indicates that there is no relationship between the differences in scores and the differences in fouls missed by winning and losing teams. Due to the fact that the group studied represented only thirty games, the low correlations found were due to the factor of chance.

Analysis of frequencies of conversions and fouls committed. Table IV reveals the frequency, the mean, standard deviation and standard error of the mean for the fouls committed, fouls converted, and fouls missed by the winning teams.

TABLE IV

FREQUENCIES AND MEANS OF FOULS COMMITTED, FOULS CONVERTED, AND FOULS MISSED BY THE WINNING TEAMS

Item	f	Mean	Standard Deviation	Standard Error of Mean
Fouls Committed	515	17.17	5.38	1.00
Fouls Converted	391	13.06	3.91	.72
Fouls Missed	257	8.56	2.91	.53

Table V reveals the frequency, the mean, the standard deviation, and the standard error of the mean for the fouls committed, the fouls converted, and the fouls missed by the losing teams.

TABLE V

FREQUENCIES AND MEANS OF FOULS COMMITTED, FOULS CONVERTED, AND FOULS MISSED BY THE LOSING TEAMS

Item	f	Mean	Standard Deviation	Standard Error of Mean
Fouls Committed	545	18.17	4.27	.79
Fouls Converted	334	11.16	3.61	.67
Fouls Missed	242	8.06	3.31	.61

By a comparison of Tables IV and V, it will be noted that the winning teams missed more foul shots at the free throw line, yet had a better average then did the losing teams. This is due to the fact that the winning teams had a greater number of shots at the free throw line.

In order to determine whether or not the difference in means between the items considered in Tables IV and V are true differences or chance differences, critical ratios were computed. The 0.1 per cent level of significance was selected because of the limited number of games observed, and because of the element of human error that is inherant in the task of officiating. To be significant at the 0.1 per cent level, the differences of means in Tables IV and V when divided by the standard errors of the means must result in a critical ratio of 3.00 of higher. The critical ratios between the winning and losing teams for the considered items were found to be as follows:

*In Tables IV and V, the total fouls converted and missed does not equal the total fouls committed, in that major fouls resulted in two free throw attempts.

Fouls committed 1.00

Fouls converted 1.30

Fouls missed 68

Due to the low critical ratios obtained above, it may be stated that the differences between winning and losing teams were not statisically significant at the 0.1 per cent level.

On the basis of Sorenson's [10] table, indicating the chances in 1000 which a true difference would be expected to occur, the following values were assigned:

1.00 . . . . . 841.

1.30 . . . . . 903.

.68 . . . . . 752.

Table VI indicates the types of fouls that were committed by the winning and losing teams. These types were arbitrarily numbered. The interpretation of these types are as follows: P_1-hacking, P_2-charging, P_3-pushing, P_4-blocking, P_5-holding, P_6-pickoff, P_7-hooking, P_8-hipping, P_9-tripping, P_{10}-unnecessary roughness, P_{11}-unsportsmanlike conduct. A comparison was made between the five fouls most frequently committed as determined by two studies of the National Rules Committees, and the five fouls most frequently committed by the group considered in this study. This comparison is shown below ranked in order from the highest to the lowest:

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10 Sorenson, H. Statistics for Students of Psychology and Education. McGraw-Hill Co., N. Y., 1936, p. 367

TABLE VI

TYPES OF FOULS COMMITTED IN THIRTY GAMES

Game Number	P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	P 11	T	Totals
8	4	7	14	1	3	0	3	1	2	0	0		36
13	5	7	6	7	8	0	2	0	1	0	0		36
29	4	3	12	5	4	1	1	0	0	0	0		30
4	5	8	20	3	9	1	3	1	1	2	0		53
15	5	2	3	0	4	0	0	0	0	0	0	1	15
9	4	5	7	5	6	2	2	0	1	0	0	1	33
10	7	3	4	2	9	1	1	0	0	0	0		27
3	7	5	10	5	2	0	5	0	1	0	0	2	37
26	6	11	8	4	10	0	0	0	0	0	0		39
18	4	15	4	2	7	0	0	0	0	0	0		32
24	4	6	8	4	10	2	2	1	1	1	0		39
21	5	10	19	4	12	0	0	0	0	0	0		50
19	3	5	6	4	2	1	1	0	1	0	0		23
17	6	12	5	3	4	1	1	0	0	0	0		32
5	8	4	12	4	4	2	1	0	1	0	0	2	38
7	9	6	9	4	7	1	1	1	0	0	0		38
30	4	6	10	4	10	0	1	0	0	0	0		35
27	4	7	8	3	5	1	0	1	0	0	0		29
6	8	8	17	3	4	1	1	0	1	0	0		43
23	5	5	8	4	5	0	1	0	0	0	0		28
2	6	6	18	1	1	0	1	2	1	0	0		36
14	9	5	4	4	8	0	1	1	0	1	1	1	35
12	9	5	11	2	10	1	2	0	0	0	0		40
22	5	11	8	2	4	0	0	0	0	0	0		30
20	5	7	4	6	3	1	0	0	0	0	0		26
11	10	12	9	4	11	0	2	1	0	0	0	1	52
16	5	7	10	4	7	0	0	0	0	0	0		33
28	7	11	11	5	11	0	2	0	2	1	0		50
1	3	6	13	4	7	1	1	1	1	0	0		37
25	3	4	6	4	8	1	1	0	0	0	0	1	28
Totals N 30	169	209	287	107	195	18	36	10	14	5	1	9	1060

Type Fouls (National Rules Committees Studies)		Type Fouls (This Study)
1st study	2nd study	
(1) Pushing	(1) Holding	(1) Pushing
(2) Holding	(2) Pushing	(2) Charging
(3) Hacking	(3) Charging	(3) Holding
(4) Blocking	(4) Hacking	(4) Hacking
(5) Charging	(5) Blocking	(5) Blocking

It is interesting to note in the comparison of the various types of fouls that were committed, the same five types of fouls predominated in the 1930-31 and in the 1932-33 intercollegiate basketball season as well as in the 1947-48 season, even though the studies were carried out in differenct parts of the country with a time difference of 15 years.

Table VII shows the number and the percentage of the various type fouls that were committed by the group considered in this study.

TABLE VII

NUMBER AND PERCENTAGE OF EACH TYPE FOUL COMMITTED RANKED FROM THE HIGHEST TO THE LOWEST

Type	Number	Per Cent
P-3	287	27.31
P-2	209	19.88
P-5	195	18.56
P-1	169	16.08
P-4	107	10.18
P-7	36	3.42
P-6	18	1.71
P-9	14	1.33
P-8	10	.95
P-10	5	.48
P-11	1	.09
T	9	.85

Table VIII shows the relative frequency of fouling on the part of the offensive and defensive teams, illustrating the higher frequency of fouls committed by the team on the defensive.

TABLE VIII

RELATIVE FREQUENCY OF FOULING ON THE PART OF THE OFFENSIVE AND DEFENSIVE TEAMS

Item	Winners	Losers
Defensive fouls	396	448
Offensive fouls	119	97

It is interesting to note that the winners committed less defensive fouls than did the losers, and the winners committed more offensive fouls than did the losers. It would appear from the data included that winning teams tend to be more aggressive when on the offensive; hence committing a greater number of fouls while endeavoring to score.

Fouls committed by zones. Figure 2 shows the relative frequency with which fouls occurred in the ten zones by both winning and losing teams. A study of this figure indicates that the greatest percentage of fouls were committed in zones 1, 4, 5, 8, 9, and 10.

Table IX shows the relative frequency with which fouls were committed by periods and zones. A study of this table shows that 28.40 per cent or 302 fouls were committed in the last period of the game. This factor might possibly be attributed to fatigue or attempts on the part of the losing team to gain possession of the ball.

FIGURE 2

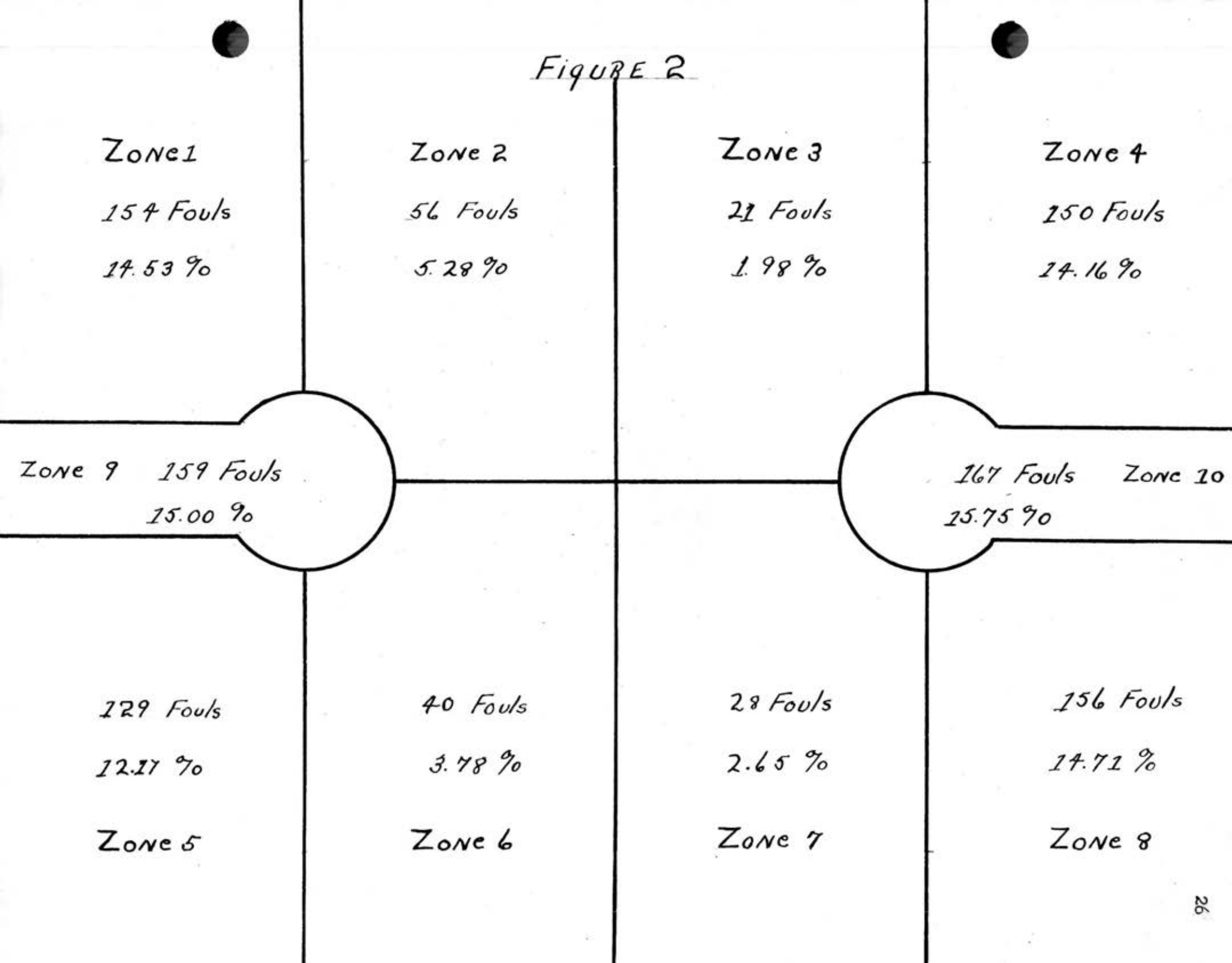
ZONE 1
154 Fouls
14.53 %
ZONE 2
56 Fouls
5.28 %
ZONE 3
21 Fouls
1.98 %
ZONE 4
150 Fouls
14.16 %
ZONE 9
159 Fouls
15.00 %
167 Fouls
15.75 %
ZONE 10
129 Fouls
12.17 %
40 Fouls
3.78 %
28 Fouls
2.65 %
156 Fouls
14.71 %
ZONE 5
ZONE 6
ZONE 7
ZONE 8

TABLE IX

FOULS COMMITTED BY PERIODS AND ZONES

Zone Number	Periods 1	2	3	4	Overtime	Totals
1	30	38	41	42	3	154
2	12	18	15	9	0	56
3	4	4	6	7	0	21
4	37	32	36	43	2	150
5	29	31	27	42	0	129
6	8	7	10	15	0	40
7	5	6	6	11	0	28
8	33	33	37	51	2	156
9	38	34	42	44	1	159
10	42	53	34	38	2	167
Totals	238	256	254	302	10	1060
Total Percent	22.44	24.15	23.97	28.40	.94	99.90

Table X shows the relative frequency with which fouls were committed, in terms of major and minor fouls. A major foul is one in which the player fouled is given two free throw attempts at the basket. A minor foul gives the player fouled only one free throw attempt at the basket. A study of Table X shows that losing teams committed more major fouls than did winning teams. This table also shows that winning teams committed more minor fouls than did losing teams. Fouling on the part of both winning and losing teams neither tended to increase or decrease as the season progressed.

TABLE X

MAJOR AND MINOR FOULS COMMITTED BY WINNING AND LOSING TEAMS

Game Number	Winning Teams Major	Minor	Losing Teams Major	Minor
8	0	18	1	17
13	4	20	1	11
29	0	17	1	12
4	1	27	6	19
15	3	1	0	10
9	1	13	2	16
10	2	10	5	10
3	2	17	6	10
26	3	19	4	13
18	3	10	4	15
24	2	19	3	15
21	2	22	7	19
19	2	7	0	14
17	1	14	2	15
5	3	14	6	13
7	0	18	7	13
30	0	19	3	13
27	8	9	4	8
6	2	19	5	17
23	2	10	0	16
2	3	15	2	16
14	0	14	6	14
12	3	15	5	17
22	0	15	8	7
20	0	12	3	11
11	3	19	2	28
16	3	10	6	14
28	3	23	2	22
1	1	15	1	20
25	3	8	2	14
TOTALS	60	449	104	439

CHAPTER V

SUMMARY AND CONCLUSIONS

It was the purpose of this study to analyze the fouls committed, in thirty intercollegiate basketball games played at the Boston Garden and B oston Arena, Boston, Massachusetts during the 1947-48 basketball season.

The frequencies of the items considered were treated statisically in terms of winning and losing teams. The considered items are shown below:

(1) Fouls committed by winning and losing teams.

(2) Fouls converted by winning and losing teams.

(3) Free throws missed by winning and losing teams.

(4) Relationship between differences in scores and differences in fouls committed by winning and losing teams.

(5) Relationship betwen differences in scores and differences in fouls converted by winning and losing teams.

(6) Relationship between differences in scores and differences in fouls missed by winning and losing teams.

(7) The zones in which the fouls were committed and the frequency of fouling on periods.

(8) The various type of fouls that were committed.

Summary of the findings. On the basis of the group observed, the following findings were obtained: (1) 51.41 per cent of the fouls were committed by the losing teams; (2) 63.41 per cent of the major fouls were committed by the losing teams; (3) 50.56 of the minor fouls were committed by the winning teams; (4) 60.34 per cent of the free throws attempted by the winning teams were converted; (5) 57.98 per cent of the free throws

attempted by the losing teams were converted; (6) 55.09 per cent of the total offensive fouls were committed by the winning teams; (7) 53.08 per cent of the total defensive fouls were committed by the losing teams; (8) 28.04 per cent of the total fouls committed, were committed in the last period of play; (9) the five types of fouls most frequently committed, ranking from highest to lowest, were: pushing, charging, holding, hacking, and blocking; (10) zones 1, 4, 5, 8, 9, and 10 were the zones in which the majority of the fouls were committed; (11) the coefficients of correlations obtained, indicate a slight relationship between the differences in scores and the differences in fouls committed between the winning and losing teams, but no relationship between the differences in scores and the differences in fouls converted between the winning and losing teams; (12) the critical ratios derived show that there were no significant differences between the fouls committed and fouls converted between the winning and losing teams.

Conclusions. It can be concluded from the observations made upon the group considered in this study, that there was a slight tendency toward the relationship between the differences in scores and the differences in the fouls committed between the winning and losing teams.

From this study there was apparently very little difference between the number of fouls committed by the winning and losing teams.

There was discerned a noticeable trend for the number of fouls committed to increase as the number of field goals increased. This may occur as a result of the faster moving of the ball, thus more area and involving more personal in the play thus increasing the possibility of fouling.

The data of this study revealed that the five types of fouls most frequently committed were: (ranked in order of their frequency) (1) pushing, (2) charging, (3) holding, (4) hacking, (5) blocking.

In the position study of fouls committed, (Figure 2), it is indicated that many fouls are committed under and around the basket. A possible means of eliminating the accumulation of fouls in this area may be by certain rule changes, which increase the value of field goals scored outside an arc of 15 - 20 feet. An effort to reduce the number of fouls committed in the areas in question would lessen the emphasis on team play around the basket and reemphasize the offensive aspect of basketball.

Evidently there is some effect upon the total score which is more evident on the part of the winning teams when free throw attempts are converted. This may be interpreted from data, in that winning teams had more free throw attempts and converted a higher percentage of these attempts.

By observation of the results obtained, by treating the data gathered with the critical ratio technique, it is evident that little significance can be placed upon fouls committed and fouls converted and their effect upon successful team performance.

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APPENDIX

TABLE A

THIRTY BASKETBALL GAMES ARRANGED IN ORDER OF INCREASING POINT DIFFERENCE

Designation	Game Number	Winners Score	Losers Score	Difference in Score
A	8	55	53	2
B	13	47	45	2
C	29	65	62	3
D	4	68	62	6
E	15	56	50	6
F	9	48	42	6
G	10	66	57	9
H	3	63	54	9
I	26	58	49	9
J	18	71	61	10
K	24	64	54	10
L	21	70	59	11
M	19	45	34	11
N	17	45	34	11
O	5	62	50	12
P	7	60	48	12
Q	30	59	47	12
R	27	61	48	13
S	6	75	61	14
T	23	62	46	16
U	2	52	36	16
V	14	61	44	17
W	12	70	51	19
X	22	73	47	26
Y	20	62	36	26
Z	11	76	49	27
A1	16	71	44	27
B1	28	80	51	29
C1	1	80	45	35
D1	25	90	35	55
	No 30	Total 1915	Total 1454	

TABLE B

FOULS COMMITTED BY ZONES

Game Number	1	2	3	4	5	6	7	8	9	10	Totals
8	5	2	1	5	5	2	2	5	5	4	36
13	10	0	0	6	2	4	0	5	4	5	36
29	7	1	0	9	3	1	0	0	6	3	30
4	6	4	3	5	7	5	0	10	8	5	53
15	2	0	0	2	3	0	0	2	3	3	15
9	3	3	0	4	4	2	0	5	7	5	33
10	3	0	0	8	3	0	0	4	5	4	27
3	2	2	2	5	4	0	2	12	4	4	37
26	7	3	0	8	6	3	1	2	3	6	39
18	6	2	0	5	7	1	1	2	3	5	32
24	5	0	0	4	5	2	0	6	7	10	39
21	8	3	0	8	5	3	0	4	11	8	50
19	3	0	0	2	3	0	3	4	3	5	23
17	3	0	1	5	1	0	1	7	6	8	32
5	4	4	1	5	8	3	1	8	1	3	38
7	8	4	0	2	4	0	2	5	7	6	38
30	7	1	1	5	6	0	0	6	3	6	35
27	7	1	0	5	5	1	0	2	3	5	29
6	6	2	0	7	3	1	2	10	4	8	43
23	3	0	0	7	5	0	1	5	3	4	28
2	5	2	0	4	4	3	0	6	7	5	36
14	6	4	1	4	2	0	5	4	3	6	35
12	5	5	0	6	4	2	0	6	7	5	40
22	3	2	3	5	4	1	0	1	7	4	30
20	1	0	0	5	4	0	1	4	6	5	26
11	7	3	5	8	5	3	3	6	5	7	52
16	6	0	0	3	4	0	0	5	6	9	33
28	8	2	2	3	7	1	1	8	10	8	50
1	6	4	1	4	4	1	2	4	7	4	37
25	2	2	0	1	2	1	0	8	5	7	28
Totals	154	56	21	150	129	40	28	156	159	167	1060

TABLE C

FOULS COMMITTED BY WINNERS AND LOSERS
IN PERIODS OF PLAY

Game Number	Winners Periods					Losers Periods					
	1	2	3	4	Overtime	1	2	3	4	Overtime	Total
8	2	7	3	4	2	4	6	5	2	1	36
13	6	6	7	5	0	2	3	4	3	0	36
29	4	3	6	4	0	2	4	5	2	0	30
4	6	5	8	9	0	6	6	6	7	0	53
15	1	0	2	2	0	0	1	2	7	0	15
9	5	3	3	4	0	4	5	5	4	0	33
10	5	2	3	2	0	3	5	2	5	0	27
3	4	6	5	6	0	4	3	3	6	0	37
26	3	6	3	6	4	4	3	2	5	3	39
18	2	4	4	3	0	5	4	4	6	0	32
24	2	5	7	7	0	0	4	6	8	0	39
21	4	5	8	7	0	3	7	7	9	0	50
19	3	4	2	0	0	3	5	4	2	0	23
17	1	5	4	5	0	7	3	3	4	0	32
5	5	3	6	4	0	4	6	5	5	0	38
7	4	2	5	7	0	5	4	6	5	0	38
30	7	2	3	7	0	7	1	1	7	0	35
27	3	6	4	4	0	3	0	3	6	0	29
6	2	9	2	8	0	4	5	6	7	0	43
23	2	3	2	5	0	5	5	1	5	0	28
2	7	2	4	5	0	3	4	4	7	0	36
14	2	5	1	6	0	4	3	6	8	0	35
12	5	5	3	5	0	4	4	7	7	0	40
22	3	4	4	4	0	6	1	3	5	0	30
20	2	3	2	5	0	3	4	4	3	0	26
11	3	8	9	2	0	6	8	6	10	0	52
16	3	6	1	3	0	6	7	2	5	0	33
28	8	7	6	5	0	8	3	8	5	0	50
1	3	4	5	4	0	5	4	7	5	0	37
25	4	4	3	1	0	7	4	2	3	0	28
N 30	111	134	125	139	6	127	122	129	163	4	1060

TABLE D

FOULS COMMITTED IN LAST FOUR MINUTES OF PLAY

Game Number	Winners	Losers
8	2	2
13	2	3
29	2	3
4	3	2
15	1	3
9	1	2
10	2	2
3	5	3
26	1	2
18	5	0
24	3	4
21	3	3
19	0	0
17	2	3
5	2	4
7	2	4
30	2	4
27	1	1
6	3	5
23	1	2
2	3	4
14	3	4
12	2	3
22	0	1
20	2	4
11	1	3
16	1	1
28	3	1
1	5	2
25	1	3
No 30	Total 64	Total 78