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A Proposed FIFA Tournament Format

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Abstract. We computationally formalized and established that though existing FIFA world cup tournament formats guarantee that the gold medalist is indeed the best team of the tournament, none guarantees that the silver and bronze medalists are the 2nd and 3rd best teams respectively. A tournament format is proposed that does not only guarantee that these three medals goes to the most deserving teams in a tournament but also reinforces some of FIFA's promotions: sportsmanship, world peace and unity as well as the economic boost, particularly, of the host nation(s). The formalism and analysis were based on the assumption that a team's capability is constant all through a tournament and no two teams have equal capability.

Keywords: FIFA, tournament format, computer algorithm

1. Introduction

FIFA, an acronym for Fédération Internationale de Football Association, is an umbrella organization responsible for governing the rules of the game of football all over the world, it is made up of six confederations and together they organize various football tournaments for men and women, the biggest being the FIFA World Cup held every four years except in 1942 and 1946 when it was not held because of the Second world war. Since the inception of the FIFA World Cup tournament in 1930, the world football governing body has applied different tournament formats; however the same pattern is used from 1986 till date even with increased number of teams in the tournaments.

FIFA has done much to improve competitiveness and avoid appearance of favoritism, blind luck (good or bad) in the tournaments by using different policies and rules to select how the teams are scheduled to play. However, inequalities still reign at every World Cup and the tournament format has remained unfair to some participating teams. For example, as the draws for the 2010 World Cup was concluded there were mixed reactions from coaches and football officials. Ivory Coast manager, Vahid Halilhodzic said, "Our team has been handed the toughest draw". A little wonder why the Ivorian Elephant went out at the first round.

Still on the inequality with the present tournament format; at World Cup draws teams are seeded and assigned to groups by chance and this have left a wild imbalance between groups where there could be "group of death" with three of four very strong teams on one hand and groups with only one or two dominant teams, where the teams that will advance is fairly obvious from the opening kickoff of the first match. This is to say that the relative strength of groups is "out of whack" to the point that in some groups every team need to play full out for 90 minutes, while in some others reserve-laden squad can move their team into the next round [1].

Apart from the disparities among the seeded teams there are often unbalanced brackets at the knock-out stage where more of the strongest teams may be in one part of the bracket so that two of the strongest teams in the tournament meet in a round of 16, quarter final or semi finals. With this, we see that the tournament format may kill off strong teams rather too quickly. Consider this; if the so called gold and silver medalists in a given tournament had met say at the quarter final instead of the final, it means that the silver medalist would have been out of the tournament without winning any medal.

From the aforementioned discussions, it is evident that the present FIFA tournament format is subject to bias, chance and does not necessarily guarantee a true silver and bronze medalist, and therefore need to be re-examined.

If we assume that the playing capability of each team in a given tournament is unique and constant for all

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matches played in the tournament, it will be safe to assign a unique positive integer Z^+ to individual team to represent their playing capability. With this assumption, the FIFA tournament format is obviously a multi-phased search algorithm that identifies the largest, 2nd largest and 3rd largest integers in some order. This paper explicates the various tournament formats used by FIFA at one time or the other, represented and analysed them as computer algorithms based on the assumption, with a view to establishing their reliability (truism of medalists) and implementation cost (number of matches played). Our findings showed that existing FIFA tournament formats are not reliable and in virtually all cases, expensive to implement. We proposed a reliable tournament format whose implementation cost is lower than all but the 2nd FIFA (1934/1938 world cups) format. We further drew real life inferences from the computational analysis to see how well they satisfy FIFA's promotion of sportsmanship, world peace and unity as well as the economic boost particularly of the host nation(s) and made evident that the proposed tournament format reinforces these FIFA's promotions.

The remaining part of the paper is organised as follows: section two exposed the various FIFA tournament formats in chronological sequence from 1930 till date. These tournament formats were represented and analysed as computer algorithms in section three. Computer algorithms and its associated terminologies may be rather too strange to most of the target audience; hence the relevant fundamentals of algorithmic science – the body of knowledge responsible for the design and analysis of computer algorithms, were introduced at the beginning of section three. Section four, presented and analysed the proposed tournament format as a computer algorithm. This section also contained the real life inferences and how they were drawn from computational analyses of the basic FIFA tournament formats and the proposed tournament format. Section five holds the conclusion.

2. FIFA Tournament Formats

Football has come a long way from being an obscure game held as a demonstration sport to be the world's favourite and most widely viewed game. The contemporary history of football can be traced to 1863 in England when rugby football and association football branched off on their different courses and then the English Football Association (FA) in England was formed, becoming the sport's first governing body. Despite the creation of the FA there were disputes regarding the rules and ownership of the rules of the game. However, the creation of the International Football Association Board (IFAB) in 1882 finally put an end to all arguments. IFAB was made up of two representatives from each of the four associations of the United Kingdom (England, Scotland, Wales and Northern Ireland). Then, as it is today, a three-quarter majority was needed for a proposal to be passed. FIFA became a member of the IFAB in 1913 though they remained eight votes and the 75 percent majority needed for a proposal to be passed, but instead of two each; England, Scotland, Wales and Ireland now had one vote while FIFA was given four.

As football grew in popularity in other parts of the world at the turn of that century, it was held as a demonstration sport in the 1900 and 1904 summer Olympics. Though FIFA tried to arrange an international football tournament between nations outside the Olympics framework in Switzerland in 1906, it was not successful. At the 1908 Olympic in London, football became an official competition, but it was not until 1914 FIFA agreed to recognize the Olympic tournament as a "world football championship for amateurs". This paved the way for the world's first international football competition at the 1920 summer Olympics. As a result of the success of the Olympics football tournament, FIFA again started looking at staging its own international tournament outside of the Olympics. On the 28th of May 1928, the FIFA congress in Amsterdam decided to stage a world championship itself. With Uruguay now two-time official football world champions 1924 and 1928 Olympic champions and to celebrate her centenary of independence in 1930 were given the right to host. This inaugural edition of the FIFA World Cup was contested as a final tournament of only 13 teams. Since then, the World Cup has experienced increased number of participating teams and changes to its tournament format; as chronologically presented below [2]:

- The First World Cup Format (1930 World Cup)

At this inaugural edition there were four groups scheduled to play a round-robin tournament and the group winners in each group advanced to the semifinals. Here, single elimination matches were played to determine the champion. Though similar to present format, no third place match was played.

- The Second World Cup Format (1934 and 1938 World Cups)

In these world cup tournaments, single elimination tournament was used throughout the tournament. This is the only world cup format without a group stage.

- The Third World Cup Format (1950 World Cup)

In this tournament there was a first group stage of 4 groups of 4 teams each. The group winners then played a second group stage. In this final group stage, the final ranking was used to determine the champion. This is the only tournament without an official final match.

- The Fourth World Cup Format (1954, 1958, 1962, 1966 and 1970 World Cups)

In this world cups, 16 teams were drawn in four groups of four teams each, followed by series of single elimination tournaments. In this format, group winners and runners-up of each group qualified and a group winner played the runner up of another group in the first elimination series (quarter finals). The semi-finals, third place and finals were as with the present format.

- The Fifth World Cup Format (1974 and 1978 World Cups)

At these FIFA world cups a first group stage of 4 groups was followed by a second group stage of 2 groups which had the first round group winners and runners-up. This was followed by the final with the group winners of the second group stage while the runners-up played a third place match.

- The Sixth World Cup Format (1982 World Cup)

At the world cup finals the number of participating team was increased to 24 and there was a first group stage of 6 groups with 4 teams each. The winners and runners-up advanced to the second group stage having 4 groups of 3 teams each. The winners of the groups at this stage went on to play the single elimination as in the present semi-finals, third place and finals.

- The Seventh World Cup Format (1986 and 1994 World Cups)

A first group stage as in 1982. This is followed by a series of single elimination with 16 teams that is the group winners, runners-up and four best third place teams. The obvious difference between this format and the current world cup format is that its number of groups is less by two and to compensate for the winners and runners-up of these two none existing groups, four best third place teams are used instead. This particular format is still used at the Under-20 FIFA World Cup Men's tournament.

- The Eight World Cup Format (1998 World Cup till date)

Since 1998, the number of participating teams increased to 3**2 to** give more slots to African and Asian nations. This necessitated the review of the seventh world cup format as the first round (group) stage increased from six groups to eight groups and then followed by a series of single elimination tournaments. The first of the elimination series comprises group winners and another group runners up thereafter winners eliminate themselves in subsequent single elimination series until the second to the last where the losers play for third place and the winner of the final elimination series getting the first place and the loser, the second place.

For better comprehension, these formats are depicted in Fig.1.1 – Fig.1.8; with the respective teams playing capability (weight) captured in Table1.

Table1: Teams with their playing capability

Weight	450	400	120	350	300	250	45	50	60	500	40	30	20	10	70	100
Team																
Weight	90	80	280	260	110	600	650	655	160	150	130	170	180	190	15	87
Team																

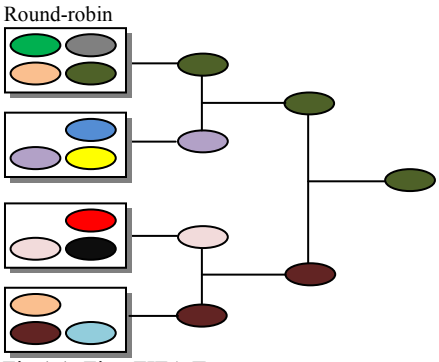

Fig.1.1: First FIFA Tournament

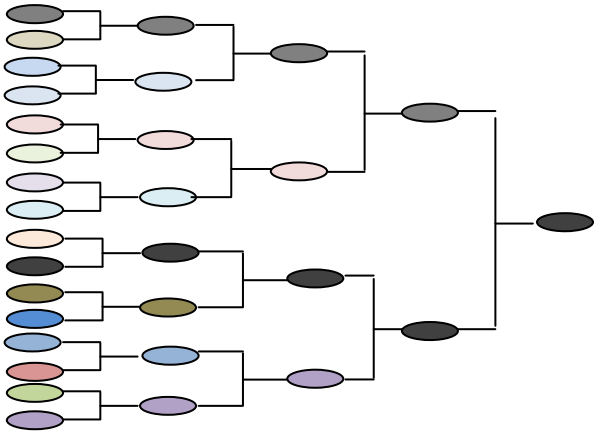

Fig. 1.2: Second FIFA Tournament

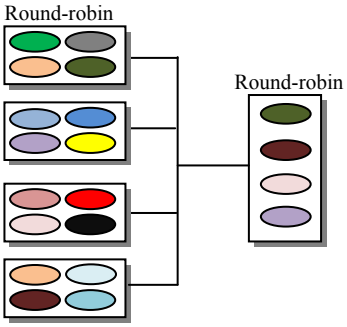

Fig.1.3: Third FIFA Tournament Format

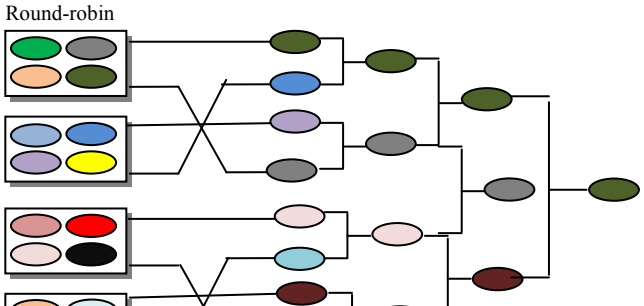

Fig.1.4: Fourth FIFA Tournament Format

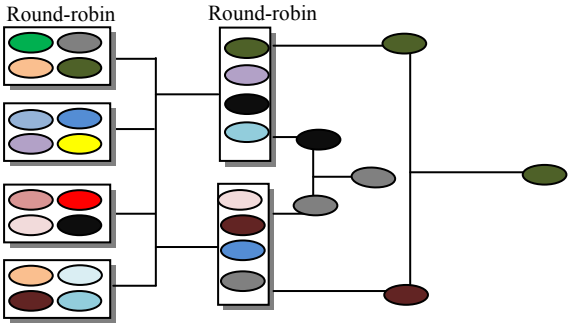

Fig.1.5: Fifth FIFA Tournament

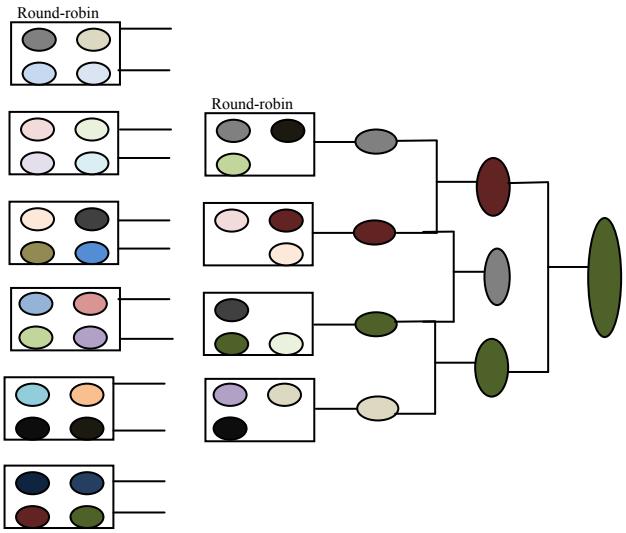

Fig.1.6: Sixth FIFA Tournament Format

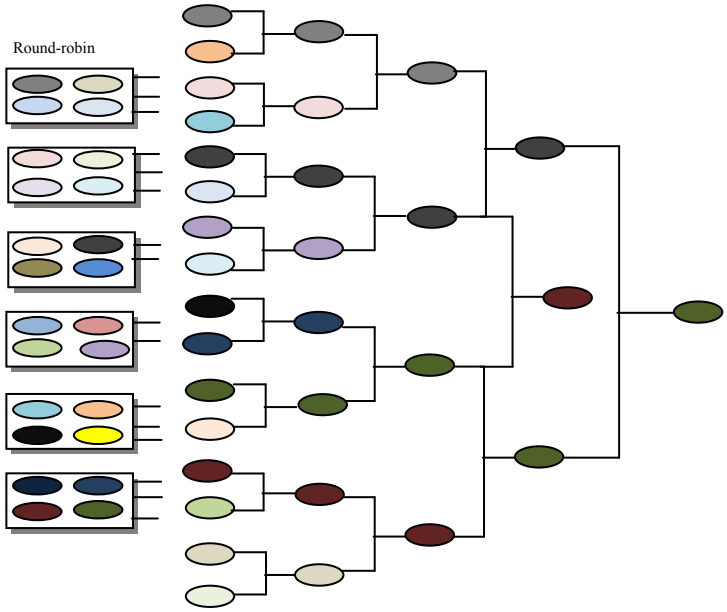

Fig.1.7: Seventh FIFA Tournament Format

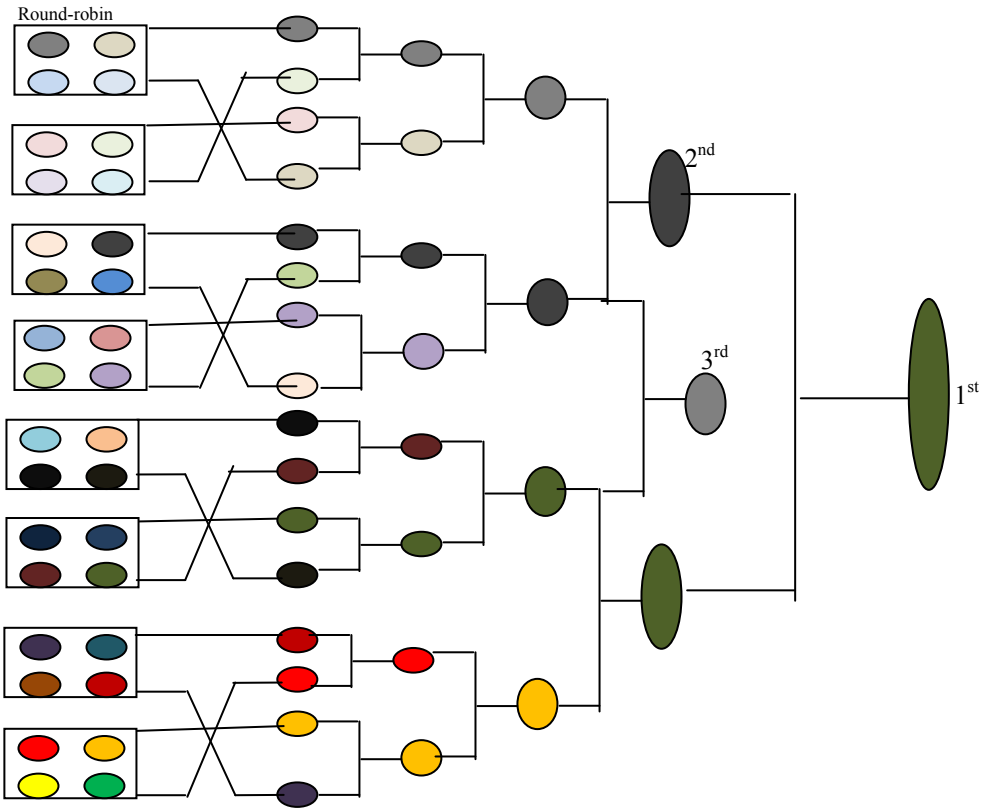

Fig.1.8: Eight FIFA Tournament Format

3. Algorithm Representation and Analysis of FIFA Tournament Formats

When we talk about algorithm we mean "a procedure consisting of a finite set of unambiguous rules which specify a finite sequence of operations that provides the solution to a problem or to a specific class of problems" [3]. Obviously, tournament formats are algorithms and to make them computable or computer algorithms, we made the safe assumption of uniqueness and constants of team capability. A Computer algorithm can be represented in many forms including pictorial representation with its finest form being a computer program.

The goal of algorithmic analysis is the 'goodness' of an algorithm particularly relative to its alternatives [3,4] and as an exact science, is subject to quantitative laws [5]. Hence, we assigned weights, positive integers, to individual teams. How good an algorithm is, is usually based on a variety of criteria or complexity (or cost) function F(n) where n defines the problem size (in our case, number of teams in a tournament) [3]. Thus for the tournament format, criteria must 1) guarantee truism of medalist (medal complexity) 2) ensure acceptable time frame of implementation (match complexity) 3) promote sportsmanship, world peace and unity as well as the economy particularly of host nation(s) (social-economic complexity). It is not possible to computationally establish the social-economic complexity of formats but good effort was made to give readers sufficient clues.

Common to most FIFA tournament format is the problem of grouping which is akin to that of list partitioning in computing. If we assume uniqueness of items in a list A, partitioning means breaking list A into smaller list $A_1, A_2, \ldots, A_k$ such that $A = A_1 \cup A_2 \cup \ldots \cup A_k$ and $A_1 \cap A_2 \cap \ldots \cap A_k = \emptyset$. Partitioning is particularly used in computer algorithms e.g. Quicksort and mergsort sorting algorithms [3,4,5]. The possible ways of doing this for k partitions (groups) is purely a combination problem. Let $t \in \mathbb{Z}^+$ be the number of teams in a group, we define t as follows:

$$\text{floor}(n/k) < t < \text{ceil}(n/k) \quad (1)$$

Consequently, the number of ways g a list of size n can be partitioned into k groups is given by:

$$g = ({}^{n}C_{t})/k = ({}^{n}P_{t}/t!)/k \quad \text{if } t = \text{floor}(n/k) = \text{ceil}(n/k) \quad (2)$$

otherwise $$g = ({}^{n-r}C_{t'} * {}^{k}P_{r})/k = (({}^{n-r}P_{t'}/t'!) * {}^{k}P_{r})/k \quad (3)$$

where $$r = n - (k*t') \quad (4)$$

and $t' = floor(n/k)$ (5)

Note therefore that the 2010 world cup groupings is just one of the possible 4,495 ways the grouping could have gone and that of the 1930 world cup was just one of the possible 220 groupings. Observe that no two groupings in a given tournament produce exactly same outcome at that group stage.

Also critical to FIFA tournament format is the initial ordering of groups which is a permutation problem. It is easy to see that this initial ordering particularly when succeeded by single elimination tournament affects the entire tournament outcome and this can be fatal; a situation where strong teams are eliminated too quickly and weaker teams promoted. If we are to consider this initial ordering of groups, then the number of all possible groupings and their relative ordering, g' (neighbor sensitive g), is given by:

$$g' = k*g \quad (6)$$

Thus, the number of neighbor sensitive groupings for the 2010 and 1930 world cups are 35,960 and 880 respectively.

It is also important we estimate the number of matches in a given tournament format. Basically, FIFA formats usually consist of round robin or single elimination tournaments. The round robin tournament is a sorting problem that arranges items in its list in some order (increasing or decreasing order). Typically, in a round robin each team plays t -1matches in a group with t teams. Thus the total number of matches to complete a round robin in such group is $(t*(t-1))/2$ or ${}^{t}C_2$ matches. Though this does guarantee truism of medalist based on our assumption, it becomes too expensive to implement as t increases. In the single elimination which is akin to a binary search problem [5], the number of matches to get a champion is n-1; and to get in addition the 2nd and 3rd positions as it is implemented today, we need n matches. This is pretty cheap but as shown later, the 2nd and 3rd positions are usually wrongly assigned; a critical threat to its reliability. As algorithmic experts, we say that the match complexity of round robin is quadratic while that of single elimination is linear.

With this background information, we are now better positioned to represent and analyse the FIFA tournament formats as computer algorithms.

3.1. The First FIFA Tournament Format

The first FIFA tournament format depicted in Fig.1.1, is algorithmically presented in Algorithm 1a.

Step1: group teams into four groups

Step2: perform round robin on group teams

Step3: perform single elimination on the (group) winners, until a winner emerges

Step4: stop

Algorithm1a: The first FIFA tournament algorithms

The above is a simplified way of representing algorithms but most often algorithmic expert prefers representing algorithms as pseudocodes, a mix of natural language (French, say) and programming language features. Since we represented these formats pictorially, we will henceforth represent them only as pseudocodes. This simplifies coding (programming) which was done in C++ [6] for each format including the proposed format to enable us expose in particular their reliability.

```
INPUT: A = array [1..n] of integers; where A[i] = A[j] iff i= j; g
OUTPUT: largest elements in A
METHOD:
        partition (A, g); // partition is a null function that groups element in A into four (g) groups
        for (int i=1; i<=g; i++) { //do for the four groups
           rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
           tA[i] = Ai[l]; // promotes the winner of each group to the next round
        }
        sElimination(tA); // sElimination, performs series of single elimination on list tA
```

Algorithm 1b: The first FIFA tournament algorithm

It is easy to see that this format for a tournament of 13 teams, require 3*(3*(3-1))/2 + 4*(4-1)/2 + 4-1 = 9+6+3 = 18 matches to get a champion and 19 matches in all to get the 2nd and 3rd positions as we do today.

3.2. The Second FIFA Tournament Format

The algorithm is purely a single elimination format (sElimination (A)).

```
INPUT: A = array [1..n] of integers; where A[i] = A[j] iff i= j
OUTPUT: largest elements in A
METHOD:
        k = 0;
        do{
                i = 0;
                do{
                        j = i+pow(2,k);
                        if (A[i]<A[j])swap(A[i],A[j]);
                        i=j+pow(2,k);
                }while(i<size);
                k++;
                kSquare = pow(2,k);
        }while (kSquare<size);
        if (A[size/4]<A[3*size/4])swap(A[size/4],A[3*size/4]);
```

Algorithm 2: The Second FIFA tournament algorithm

Observe that Algorithm 2 is a recursive algorithm and constitutes Algorithm 1. We require 16 -1 = 15 matches to get the champion in a tournament of 16 teams and 16 matches in all to get the 2nd and 3rd positions as we do today.

3.3. The Third FIFA Tournament Format

```
INPUT: A = array [1..n] of integers, where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:
        partition (A, g); // partition is a null function that groups element in A into four (g) groups
        for (int i=1; i<=g; i++) { //do for the four groups
           rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
           tA[i] = Ai[l]; // promotes the winner of each group to the next round
        }
        rRobin(tA);
```

Algorithm 3: The third FIFA tournament algorithm

With this format, we see that for a 16 team tournament, we have 5*(4*(4-1))/2 = 30 matches to get the 1st, 2nd and 3rd best teams in the tournament.

3.4. The Fourth FIFA Tournament Format

```
INPUT: A = array [1..n] of integers; where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:
        partition (A, g); // partition is a null function that groups element in A into four (g) groups
        for (int i=1; i<=g; i++) { //do for the four groups
           rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
           tA[i] = Ai[l]; // promotes the winner of each group to the next round
           tB[i] = Ai[2]; // promotes the runners up of each group to the next round
        }
        for (int i=1; i<=g; i++) tA[i] = max(tA[i], tB[g-i+1]);
```

```
sElimination(tA); // sElimination, performs series of single elimination on list tA
```

Algorithm 4: The fourth FIFA tournament algorithm

With this format, we see that for a 16 team tournament, we have 4*(4*(4-1))/2 + 4+ 2+ 1+ 1= 32 = 2*16 matches to get the 1st, 2nd and 3rd best teams in the tournament. For this algorithm and n in powers of 2, it is trivial to show that the number matches required to get the 1st, 2nd and 3rd best teams is 2n.

3.5. The Fifth FIFA Tournament Format

```
INPUT: A = array [1..n] of integers, where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:
    partition (A, g); // partition is a null function that groups element in A into four (g) groups
    for (int i=1; i<=g; i++) { //do for the four groups
       rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
       tA[i] = Ai[l]; // promotes the winner of each group to the next round
       tB[i] = Ai[2]; // promotes the runners up of each group to the next round
    }
    merge(tA, tB, At); //merges tA and tB into At
    partition (A, 2);
    for (int i=1; i<=2; i++) {
       rRobin(Ai); //
    }
    if (A1[1] > A2[1] ) {
       first = A1[1]; second = A2[1];
    }
    else {
       first = A2[1]; second = A1[1];
    }
    if (A1[2] > A2[2] ) {
       third = A1[2]; fourth = A2[2];
    }
    else {
       third = A2[2]; fourth = A1[2];
    }
```

Algorithm 5: The fifth FIFA tournament algorithm

Observe that for a 16 team tournament, we require 6*(4*(4-1)/2)+1+1 = 38 matches to get the 1st, 2nd and 3rd best teams in the tournament.

3.6. The Sixth FIFA Tournament Format

```
INPUT: A = array [1..n] of integers, where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:
    partition (A, g); // partition is a null function that groups element in A into four (g) groups
    for (int i=1; i<=g; i++) { //do for the four groups
       rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
       tA[i] = Ai[l]; // promotes the winner of each group to the next round
       tB[i] = Ai[2]; // promotes the runners up of each group to the next round
    }
```

```
merge(tA, tB, At); //merges tA and tB into At
partition (A, 3);
for (int i=1; i<=3; i++) {
   rRobin(Ai);
   tA[i] = Ai[l]; // promotes the winner of each group to the next round
} sElimination(tA); // sElimination, performs series of single elimination on list tA
```

Algorithm 6: The sixth FIFA tournament algorithm

This format require for a 24 team tournament, 6*(4*(4-1)/2)+4*(3*(3-1)/2)+4 = 52 matches to get the 1st, 2nd and 3rd best teams in the tournament.

3.7. The Seventh FIFA Tournament Format

INPUT: A = array [1..n] of integers, where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:

```
partition (A, g); // partition is a null function that groups element in A into four (g) groups
for (int i=1; i<=g; i++) { //do for the four groups
   rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
   tA[i] = Ai[l]; // promotes the winner of each group to the next round
   tB[i] = Ai[2]; // promotes the runners up of each group to the next round
   tC[i] = Ai[3]; // keep track of third place in each group
}
order(tC); // arranges tC in descending order of best loser, no match is involved
merge( tA, tB, tC, tA[1..16]); //
sElimination(tA); // sElimination, performs series of single elimination on list tA
```

Algorithm 6: The sixth FIFA tournament algorithm

This format require for a 24 team tournament, 6*(4*(4-1)/2)+16 = 52 matches to get the 1st, 2nd and 3rd best teams in the tournament.

3.8. The eight FIFA Tournament Format

INPUT: A = array [1..n] of integers; where A[i] = A[j] iff i= j; g
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:

```
partition (A, g); // partition is a null function that groups element in A into four (g) groups
for (int i=1; i<=g; i++) { //do for the four groups
   rRobin(Ai); // rRobin is a function that sorts items in a group in descending order
   tA[i] = Ai[l]; // promotes the winner of each group to the next round
   tB[i] = Ai[2]; // promotes the runners up of each group to the next round
}
for (int i=1; i<=g; i++) tA[i] = max(tA[i], tB[g-i+1]);
sElimination(tA); // sElimination, performs series of single elimination on list tA
```

Algorithm 8: The eight FIFA tournament algorithm

Note that this format is not in any way different from the fourth FIFA tournament format only that we have 32 teams now against the 16 teams then. Thus, we have a total of 2*32 = 64 matches played.

In the foregoing analysis, the match complexities (number of matches) possible with the formats were evident, what is not obvious is the truism of medalists (Gold, Silver and Bronze medals). This can easily be demonstrated using same data sets to run the algorithms (programs). The coding of some of the formalized algorithms were done using C++ [6] and run on data sets presented in Table2. Algorithms with

same principle only had the more general one implemented. For example Algorithm4, Algorithm7 and Algorithm8 are virtually same in principle.Table2 contains 32 teams with unique weights in 20 different initial ordering. They were all run on the same data set of 32 teams irrespective of the initial number of teams the format were used on since the present number of teams in FIFA world cup is 32 and to subject them to same input data for ease of appreciation of result. The implementation results are captured in Table3-Table7. The codes shall be made available on request.

Observe from Table3-Table7 that all the tournament formats were able to produce a true gold medalist in all runs but this was not the case with the silver and bronze medalist. We conclude therefore that the existing FIFA tournament formats are not reliable.

4. The Proposed FIFA Tournament Formats

From the forgoing, we no doubt need a tournament format that can guarantee the truism of the medalists in FIFA world cups with reasonable number of matches. This section proposed one such tournament formats. It is a tournament format that completely eliminates the common practice of grouping and modifies the single elimination tournament such that winners keep track of their losers, while losers (and loser losers) are allowed to compete for superiority in the set of losers of the incumbent winner. Since FIFA is only interested in three medals, we restrict a winner losers list to a maximum of size two (best loser and runners-up loser). A team is only eliminated if it is neither a winner and could not find a place in the loser list of a winner. The final winner set defines the medalists. The group concept was not considered because as established by equation 6, the possible groupings in a tournament and their initial ordering is pretty large and this opens up the tournament to a high degree of chance and makes it amenable to manipulation. Instead, we adopted the single elimination tournament because of its fast track nature but modified it, as described, to ensure the truism of medalists. This format is depicted in Fig. 1.9. and captured in Algorithm 9. The various teams playing capability is as captured in Table1.

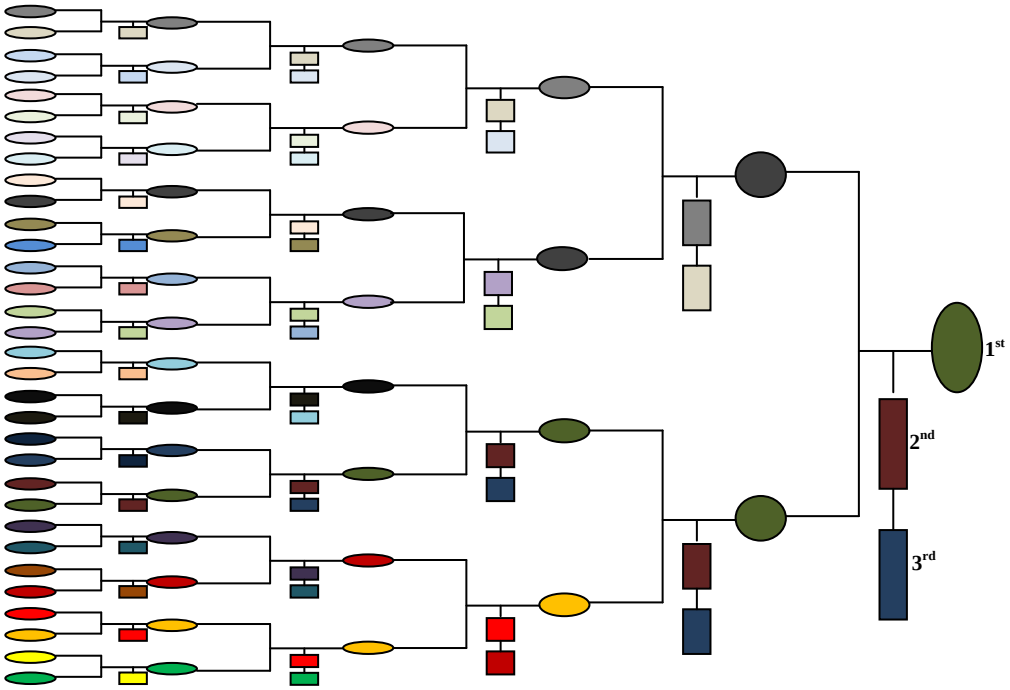

Fig.1.9: Proposed FIFA Tournament Format

INPUT: A = array [1..3, 1..n] of integers; where A[1,i] = A[1,j] iff i= j; A[r, i] = 0 for all r>1
OUTPUT: 1st, 2nd and 3rd largest elements in A, and so assigned
METHOD:

```
k = 0; //defines first round of elimination
do {
    i= 1;
```

```
do {
    j=i+2^k;
    if (A[1,i] > A[1,j])  // this if with its else statements determine winner (gold)
      if (A[2,i] >A[1,j])  // this if with its else statements determine 1st loser (silver)
        if (A[3,i]>A[1,j]) {} // this if with its else statements determine 2nd loser (bronze)
        else swap(A[3,i],A[1,j]);
      else {
        A[3,i] = A[2,i];
        swap(A[2,i],A[1,j]);
        if (A[3,i]>A[2,j]) {}
        else swap(A[3,i],A[2,j]);
      }
    else {
        A[3,i] = A[2,i];
        A[2,i] = A[1,i];
        Swap(A[1,i],A[1,j]);
        if (A[2,i] >A[2,j])
          if (A[3,i]>A[2,j]) {}
          else swap(A[3,i],A[2,j]);
        else {
          A[3,i] = A[2,i];
          swap(A[2,i],A[2,j]);
          if (A[3,i]>A[3,j]) {}
          else swap(A[3,i],A[3,j]);
        }
    }
   i=j+2^k;
  } while (i<n);
  k++; //next elimination round
} while (2^k < n)
```

Algorithm 9: The Proposed FIFA tournament algorithm

This algorithm is particularly useful in a tournament with numbers of competing teams in powers of 2. Note also that some of the comparisons do not result in matches being played. For example, at the first round (k=0), no first or second loser match takes place. Thus, the maximum number of matches required to get the 1st, 2nd and 3rd best teams in a tournament by this format is given by:

$$\left(\sum_{k=0}^{\lceil \log_2 n \rceil - 1} \sum_{1}^{3} \left(n / 2^{k+1} \right) \right) - n \tag{7}$$

Thus for a 32 team tournament, a maximum of 61 matches will be required to get the 1st, 2nd and 3rd best teams in the tournament and for a 16 team tournament, a maximum of 29 matches will be required to get the 1st, 2nd and 3rd best teams in the tournament.

As with other formats, we implemented the algorithm in C++ [6], ran it using data sets from Table2 and obtained the results in table8. From the result, it is obvious that unlike other FIFA tournament formats; this proposed format guarantees the truism of medalist.

Table 2: Possible Initial Ordering of 32 Teams in a FIFA World Cup and their Fictitious Playing Capability

400 87 45 260 130 180 500 120 450 300 280 350 110 650 170 80 250 655 60 150 40 10 70 20 160 90 50 190 600 100 15 30 655 150 180 130 350 70 120 450 60 15 20 50 650 110 40 160 190 400 87 250 300 600 10 170 260 500 45 30 280 80 90 100 450 400 120 350 300 250 45 50 60 500 40 30 20 10 70 100 90 80 280 260 110 600 650 655 160 150 130 170 180 190 15 87 87 15 190 180 170 130 150 160 655 650 600 110 260 280 80 90 100 70 10 20 30 40 500 60 50 45 250 300 350 120 400 450 260 280 80 90 100 70 10 160 655 650 600 110 250 300 350 120 400 450 87 15 190 180 170 20 30 40 500 60 50 45 130 150 45 130 180 170 20 30 40 150 60 50 260 280 80 650 600 110 250 70 10 160 300 350 120 655 400 450 87 15 90 100 190 500 400 350 450 120 45 60 50 300 250 70 20 40 10 500 60 280 110 90 260 100 80 650 130 15 190 87 170 655 130 180 600 160 170 655 130 180 160 600 400 350 450 120 260 100 80 650 130 15 190 87 45 60 50 300 250 70 20 40 10 500 60 280 110 90 20 30 40 150 60 50 260 280 300 350 120 655 400 450 87 45 130 180 170 80 650 600 110 250 70 10 160 15 90 100 190 500 250 45 50 60 500 40 30 20 10 70 100 90 160 150 130 170 180 190 15 87 450 400 120 350 300 80 280 260 110 600 650 655 280 260 300 350 120 655 110 250 70 10 160 15 90 20 30 40 150 60 50 100 190 500 400 450 87 45 130 180 170 80 600 650 70 10 160 655 650 350 120 400 450 87 15 190 260 280 80 90 100 180 250 60 50 45 130 150 170 20 30 40 500 300 110 600 600 450 650 655 500 90 160 87 15 400 130 190 110 120 45 100 180 280 80 300 350 50 60 170 260 40 30 10 150 20 250 70 15 450 260 280 45 130 180 400 250 120 170 655 20 30 40 60 150 50 500 300 110 70 10 650 100 90 80 600 160 190 87 350 120 300 400 250 450 45 350 500 60 40 50 100 10 30 70 20 280 110 260 80 90 655 160 600 150 170 130 650 87 190 180 15 190 170 160 655 150 180 130 350 400 87 250 300 600 10 100 70 120 450 60 15 20 260 500 45 30 280 80 90 50 650 110 40 87 190 15 170 130 655 180 160 150 90 70 100 600 260 110 280 80 10 40 30 130 650 20 500 250 50 120 300 45 400 60 450 450 45 350 500 60 40 50 650 87 190 180 15 120 300 400 250 130 150 170 160 600 80 90 110 655 260 70 20 10 280 30 100 500 400 450 87 45 130 280 260 300 350 120 655 180 170 80 600 650 110 250 70 10 160 20 30 40 150 60 15 90 50 100 190 30 20 10 70 100 90 160 190 15 87 450 400 120 250 45 50 60 500 40 110 600 650 150 130 170 180 350 300 80 280 655 260

Table3: 1st FIFA Format Result

Gold Medalist	Silver Medalist	Bronze Medalist
655	500	600
655	600	650
655	450	300
655	450	300
655	450	500
655	650	500
655	600	650
655	600	650
655	500	450
655	500	450
655	650	500
655	650	450
655	500	400
655	500	600
655	400	650
655	500	600
655	600	650
655	500	600
655	650	500
655	650	500

Table4: 2nd FIFA Format Result

Gold Medalist	Silver Medalist	Bronze Medalist
655	650	600
655	600	650
655	500	450
655	500	450
655	500	450
655	650	500
655	500	650
655	500	650
655	650	500
655	500	450
655	650	500
655	600	450
655	350	400
655	650	600
655	500	650
655	650	600
655	650	600
655	650	600
655	650	500
655	450	650

Table5: 3rd FIFA Format Result

Gold Medalist	Silver Medalist	Bronze Medalist
655	650	600
655	650	600
655	500	450
655	500	450
655	500	450
655	650	500
655	650	600
655	650	600
655	650	500
655	500	450
655	650	500
655	650	600
655	500	400
655	650	600
655	650	500
655	650	600
655	650	600
655	650	600
655	650	600
655	650	500

Table6: 4th, 7th &8th FIFA Format Result Table7: 5th /6th FIFA Format Result Table8: Proposed FIFA Format Result

Gold Medalist	Silver Medalist	Bronze Medalist
655	650	500
655	650	600
655	650	450
655	650	450
655	650	450
655	600	650
655	650	600
655	650	600
655	650	500
655	650	500
655	600	650
655	650	600
655	650	500
655	650	500
655	650	400
655	650	500
655	500	600
655	650	500
655	600	650
655	600	650

Gold Medalist	Silver Medalist	Bronze Medalist
655	600	650
655	650	600
655	450	500
655	450	500
655	500	450
655	500	650
655	650	500
655	650	500
655	500	650
655	450	500
655	500	650
655	450	600
655	400	350
655	600	650
655	650	500
655	600	650
655	650	600
655	600	650
655	500	650
655	650	450

Gold Medalist	Silver Medalist	Bronze Medalist
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600
655	650	600

It is easy to see that the proposed FIFA format is a more reliable format for FIFA world cups with comparably fewer matches than the known FIFA world cup formats. It is also important we examine the social economic realities of these formats, for football has grown beyond just a sport into a big business and an instrument for social integration, peace and unity across and within nations.

A format that cannot guarantee that the most deserving teams are so rewarded is not fair. Also, if two teams play a match and their people (nations) know that the success of the loser is contingent on the winner's victory, friendship will be strengthened irrespective of the match outcome. Competitiveness will improve with the proposed format since there is no room for tie or situation where matches are allegedly sold or bought as it occurs particularly at the last set of matches of the group stage. With the proposed format, support and patronage will definitely come from the supporters and people of nations on their losers list since their winner's victory means their victory.

Besides, more ticket will be sold in a match with multinational stakes. Also, FIFA will spend less as fewer but highly competitive matches will be officiated with the proposed format than with the present FIFA format. The host nation(s) will make more money with the proposed format since more teams stay longer in the competition than with other formats. The longer a people stay together in peace (friendship) the stronger their social affinity.

5. Conclusion

We computationally established that existing FIFA tournament formats do no guarantee that medals are given to the most deserving teams in FIFA world cups making FIFA medalists dependent on the initial ordering or grouping of teams. This is not healthy, as a format that cannot guarantee that the most deserving teams are so rewarded is not fair. A realistic tournament format that guarantees the truism of medallist in FIFA world cups and other related competitions or sports now exist. This proposed format is win-win-win format for all stakeholders (FIFA, host nation(s) and competing nations).

6. References

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