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Master of Management Analytics

WOMEN'S ICE-HOCKEY TEAM PREDICTION (NWHL 2021-22)

MMA Summer 2023 Online Datathon

May 1, 2024 Team White

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UNIVERSITY OF TORONTO

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TEAM WHITE MEMBERS

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BUSINESS OBJECTIVE

Assist the NWHL Toronto Six Managers assemble a team for the upcoming 2021-22 NWHL season.

ANALYTICAL OBJECTIVE

Evaluate the performance of the players and identify 5 top players.

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Data Overview

Data Sources

- **Women's hockey data from the NWHL 2020-21 Season** – Stathletes
- **Player's position, age, nationality & college –** Premier Hockey Federation (PHF) & Elite Prospects (EP)

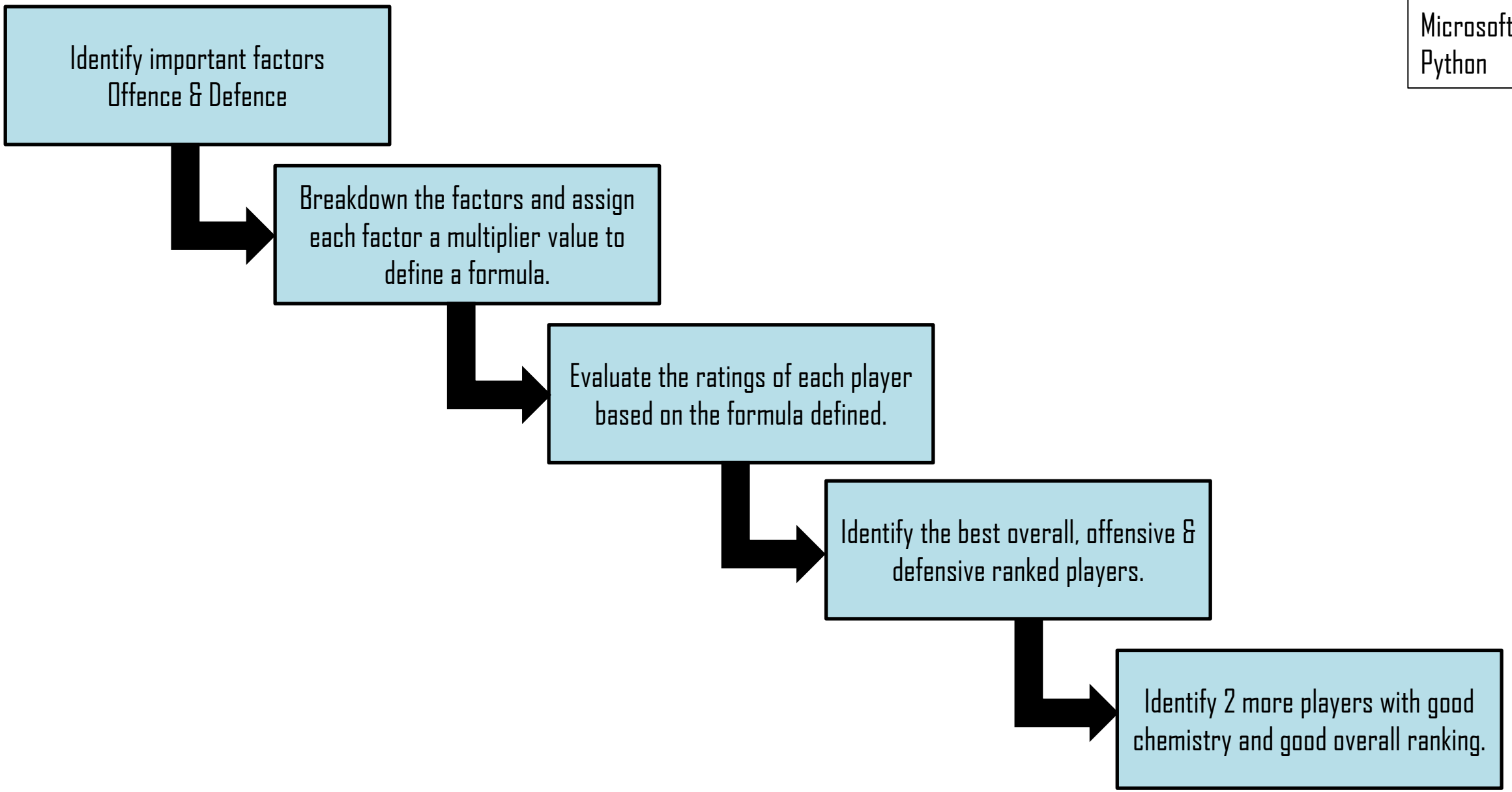
Data Description

The women's hockey data from the NWHL 2020-21 season consists of a list of events - shots, plays, takeaways, puck recoveries, dump ins, dump outs, zone entries, faceoffs and penalties. Data regarding the date, home team, away team, player, X & Y co-ordinates of the event, score, clock time and more details are included.

The player's position, age, nationality & college were manually retrieved from the PHF & EP websites.

METHODOLOGY

Tools Used:
Microsoft Excel
Python



ANALYSIS

Identifying Important Aspects

To create an equation to evaluate each player's performance as per the women's hockey NWHL 2020-21 season data, we researched online and identified the most important aspects to be considered for an offensive & defensive player individually.

Offensive Factors	Defensive Factors
1. Scoring	1. Passing
2. Passing	2. One on One Situations
3. On-Puck & Off-Puck Movement	3. Steals & Defending

EVALUATION BREAKDOWN

We have classified each of the factors based on the data. Each factor has been assigned a percentage of the total rating based on the importance of the trait in the game to help determine the overall rating.

Offensive Rating Breakdown	
Scoring (40%)	
➢ Shots	25%
➢ Goals	15%
Passing (35%)	
➢ Offensive Passing	35%
On-Puck & Off-Puck Movement (25%)	
➢ Puck Recovery (Offensive Zone)	15%
➢ Zone Entry	5%
➢ Dump In/Out (Offensive Zone)	5%
Total	**100%**

Defensive Rating Breakdown	
Passing (34%)	
➢ Defensive Passing	34%
One on One Situations (33%)	
➢ Faceoff Win (Defensive Zone)	12%
➢ Faceoff Win (Offensive Zone)	8%
➢ Dump In/Out (Defensive Zone)	13%
Steals & Defending (33%)	
➢ Takeaways	20%
➢ Puck Recovery (Defensive & Centre Zone)	13%
Total	**100%**

Overall Rating = Offensive Rating + Defensive Rating

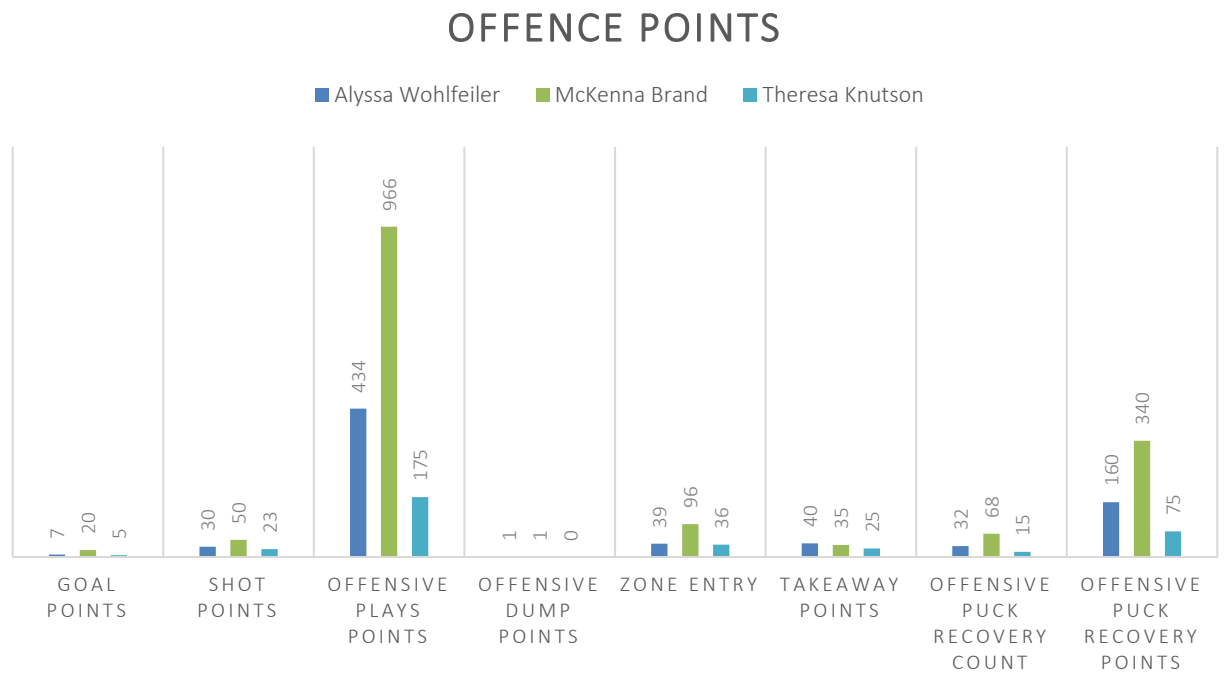
RANKING RESULTS

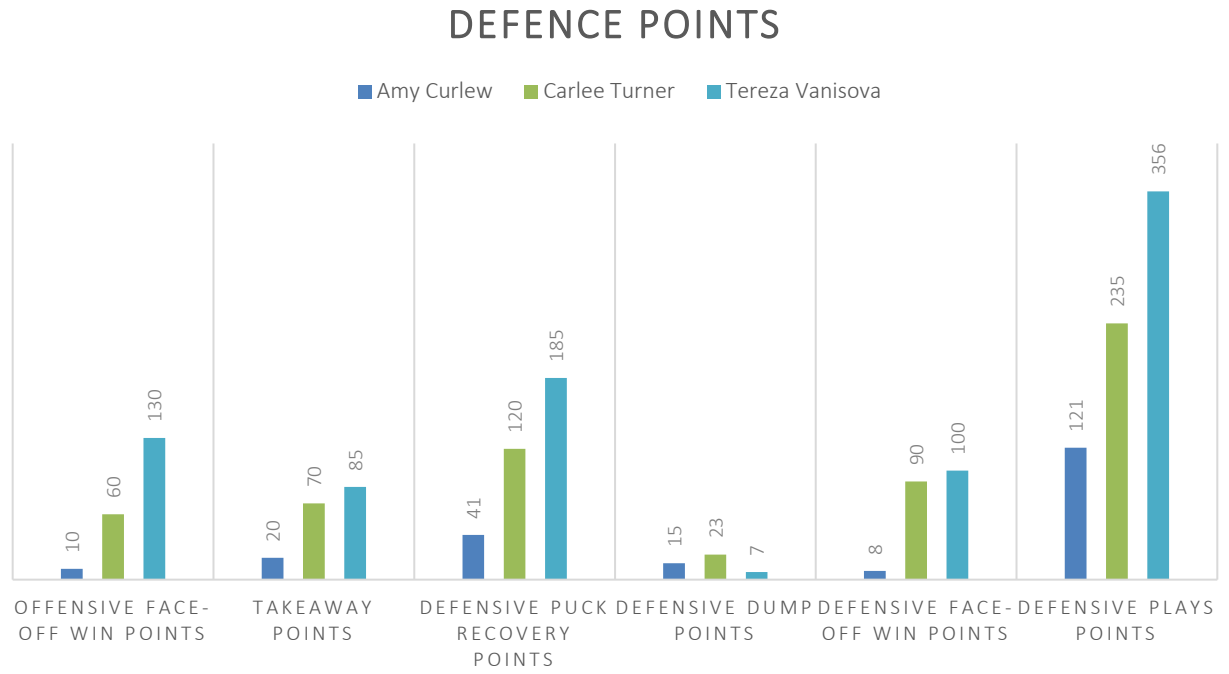
OFFENCE STATS

Ranking	Player	Rating
#1	Alyssa Wohlfeiler	59.31
#2	Theresa Knutson	59.01
#3	McKenna Brand	57.48

DEFENCE STATS

Ranking	Player	Rating
#1	Tereza Vanisova	80.97
#2	Amy Curlew	76.13
#3	Carlee Turner	76.08





IDEAL TEAM AS PER ANALYSIS

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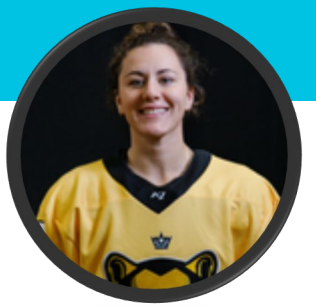
Choice 1

McKenna Brand	
Offence Ranking	#3
Defence Ranking	#4
Overall Ranking	#1
Age	27

Alyssa Wohlfeiler	
Offence Ranking	#1
Defence Ranking	#65
Overall Ranking	#24
Age	34

Tereza Vanisova	
Offence Ranking	#59
Defence Ranking	#1
Overall Ranking	#5
Age	27

Samantha Davis	
Offence Ranking	#13
Defence Ranking	#12
Overall Ranking	#7
Age	26



Taylor Wenczkowski	
Offence Ranking	#14
Defence Ranking	#19
Overall Ranking	#10
Age	25

Team Total Overall Ranking	47

Chemistry Heat Map

Players	Alyssa Wohlfeiler	McKenna Brand	Samantha Davis	Taylor Wenczkowski	Tereza Vanisova
Alyssa Wohlfeiler					
McKenna Brand					
Samantha Davis					
Taylor Wenczkowski					
Tereza Vanisova					

Result:

This team has the highest ranked players in each trait and has the experience of Alyssa to guide the team.

IDEAL TEAM AS PER ANALYSIS

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Choice 2

McKenna Brand	
Offence Ranking	#3
Defence Ranking	#4
Overall Ranking	#1
Age	27

Theresa Knutson	
Offence Ranking	#2
Defence Ranking	#10
Overall Ranking	#3
Age	27

Amy Curlew	
Offence Ranking	#5
Defence Ranking	#2
Overall Ranking	#2
Age	25

Jillian Dempsey	
Offence Ranking	#12
Defence Ranking	#29
Overall Ranking	#15
Age	32

Christina Putigna	
Offence Ranking	#20
Defence Ranking	#25
Overall Ranking	#16
Age	27

Team Total Overall Ranking	37

Chemistry Heat Map

Players	Amy Curlew	Christina Putigna	Jillian Dempsey	McKenna Brand	Theresa Knutson
Amy Curlew					
Christina Putigna					
Jillian Dempsey					
McKenna Brand					
Theresa Knutson					

Result:

This team has a better team total overall ranking and is a younger team which has a potential to grow well together.

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THANK YOU

Please refer below slides for more details on references, sources, formulas and code used.

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References & Sources

- Toronto Six Logo (Slide 2) - https://upload.wikimedia.org/wikipedia/en/9/93/Toronto_Six_Logo.png
- PHF Website - https://www.premierhockeyfederation.com/stats#/100/leaders?division_id=20048
- Elite Prospects - https://www.eliteprospects.com/stats
- Offensive Factors Image (Slide 4) - https://a.espncdn.com/photo/2022/0210/r972558_1296x729_16-9.jpg
- Defensive Factors Image (Slide 4) - https://s3.amazonaws.com/media.thecrimson.com/photos/2010/02/22/003242_1227890.jpg
- Online Research – Offensive & Defensive Factors
  - https://www.minnesotahockey.org/news_article/show/588243-3-must-have-game-skills-for-forwards
  - https://hockeyperformanceacademy.com/7-factors-that-make-a-great-defender-in-field-hockey/
  - https://www.omha.net/news_article/show/990613
  - https://www.hockeycanada.ca/en-ca/hockey-programs/players/essentials/positions-skills/skating#:~:text=Skating%20is%20a%20skill%20required,perform%20to%20their%20full%20ability.
  - https://www.hockeycanada.ca/en-ca/hockey-programs/players/essentials/positions-skills/defence
- Player Images (Slide 6 & 7) - https://www.premierhockeyfederation.com/stats#/100/leaders?division_id=20048

To evaluate the performance of the player, based on the event and details, points are allocated to the player. For example, a one-time shot goal in traffic gets +8 goal points and another +2 if the goal is scored when the scoring team is in a penalty kill situation. Another example, a fan (failure to execute) shot gets -2 shot points. These total points are then used to calculate the rating for each trait – Shots, Goals, Offensive Passing and so on. Please refer to appendix slides below for the formulas used to calculate rating, complete scoring breakdown and sample python code used to generate the points output.

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Offensive Rating – Scoring Rating + Passing Rating + On-Puck & Off-Puck Movement Rating

1. Scoring Rating:

(Goal Points/(Goal Count*Maximum Goal Points))*15% + Shot Points/(Shot Count*Maximum Shot Points))*25%

2. Passing Rating:

(Offensive Play Points/(Offensive Play Count*Maximum Offensive Play Points))*35%

3. On-Puck & Off-Puck Movement Rating:

(Offensive Puck Recovery Points/(Offensive Puck Recovery Count*Maximum Offensive Puck Recovery Points))*15% + (Zone Entry/Total Zone Entry Points)*5% + (Offensive Dump In/Out Points/(Offensive Dump In/Out Count*Maximum Offensive Dump In/Out Points))*5%

Defensive Rating – Passing Rating + One on One Situation Rating + Steals & Defending Rating

1. Passing Rating:

(Defensive Play Points/(Defensive Play Count*Maximum Defensive Play Points))*34%

Chemistry Rating:

Completed Plays Match + College Match + Team Match + Age Match

2. One on One Situation Rating:

(Defensive Faceoff Win Points/(Defensive Faceoff Win Count*Maximum Faceoff Win Points))*12% + (Offensive Faceoff Win Points/(Offensive Faceoff Win Count*Maximum Faceoff Win Points))*8% + (Defensive Dump In/Out Points/(Defensive Dump In/Out Count*Maximum Defensive Dump In/Out Points))*13%

3. Steals & Defending Rating:

(Takeaway Points/(Takeaway Count*Maximum Takeaway Points))*20% + (Defensive Puck Recovery Points/(Defensive Puck Recovery Count*Maximum Offensive Puck Recovery Points))*13%

Event + Details	Points	Event + Details	Points
1, Goal + No Traffic + No One Time*	+5	16. Takeaway	+5
2. Goal + No Traffic + One Time*	+6	17. Puck Recovery + Offensive Zone	+5
3. Goal + Traffic + No One Time*	+7	18. Puck Recovery + Defensive Zone	+3
4. Goal + Traffic + One Time*	+8	19. Puck Recovery + Centre Zone	+4
5. Shot + Fan	-2	20. Incomplete Play + Defensive/Centre Zone*	-2
6. Shot + On Net	+2	21. Dump In/Out + Lost + Defensive/Centre Zone	+1
7. Shot + Missed	-1	22. Dump In/Out + Retained + Defensive/Centre Zone	+3
8. Shot + Blocked	+1	23. Play + Direct + Defensive/Centre Zone	+10
9. Play + Direct + Offensive Zone	+10	24. Play + Indirect + Defensive/Centre Zone	+5
10. Play + Indirect + Offensive Zone	+5	25. Faceoff Win + Defensive/Centre Zone	+4
11. Incomplete Play + Offensive Zone*	-2	26. Chemistry Per Play Completed	+1
12. Dump In/Out + Lost + Offensive Zone	+1	27. Chemistry for College Match	+20
13. Dump In/Out + Retained + Offensive Zone	+3	28. Chemistry for Team Match	+10
14. Zone Entry	+3	29. Chemistry for Age Match	+10
15. Faceoff Win + Offensive Zone*	+4		

*Based on Situation – Penalty Kill/Power Play, bonus points are added/deducted.

Each event contributes to a point total.
Please refer to the below table for the mapping.

Point Total	No.
Goal Points	1,2,3,4
Shot Points	5,6,7,8
Offensive Play Points	9,10,11
Offensive Dump Points	12,13
Zone Entry	14
Offensive Faceoff Win Points	15
Takeaway Points	16
Offensive Puck Recovery Points	17
Defensive Puck Recovery Points	18,19
Defensive Plays Points	20,23,24
Defensive Dump Points	21,22
Defensive Faceoff Win Points	25

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Sample Python Code

```
for i, row in events.iterrows():
    #Goals - +2 Points if goal during Penalty Kill
    #Goal - No Traffic & No One Time 5 Points
    if(row['Event']=='Goal'and row['Detail 3']=='f' and row['Detail 4']=='f'):
        res = np.where(players == row['Player'])
        for player in res:
            if player == 0:
                continue
            (players.loc[player,'Goal Points'])+=5
            if row['Play Situation'] == 'Penalty Kill':
                (players.loc[player,'Goal Points'])+=2
```

This code assigns 5 points to the player's Goal Points tally if there is an event of the player scoring a goal in no traffic and not a one-time shot. 2 additional points are allocated if the player scores when the team is in a Penalty Kill situation.